

**FINAL REPORT
INITIAL SITE ASSESSMENT
UNION CHEMICALS SITE
CARTERET, NEW JERSEY**

Prepared for:

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DRAFT REPORT
INITIAL SITE ASSESSMENT
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1.0 INTRODUCTION

IT Corporation (IT) was retained by Union Chemicals Division of Union Oil Company of California (Union Chemicals) to conduct a site assessment at their facility in Carteret, New Jersey (Figure 1). This site assessment followed Union Chemicals' request to IT in June 1985 for emergency response action to control the seepage of organic phase contaminants (product) into Noes Creek. The Union Chemicals site requires hydrogeologic and chemical data to both assess the existing in situ conditions at the site and to permit consideration of some remedial action alternatives designed to prevent further product seepage into Noes Creek. The objectives of this investigation are to characterize the following:

- o Unconsolidated materials underlying the site
- o Site hydrogeology, including the ground water flow direction and rate
- o Extent and depth of existing subsurface contamination.

A preliminary site investigation was conducted during the emergency response action. This work entailed the excavation of five test pits and the collection of soil and water samples for chemical analysis. The information derived from this initial task was used to establish guidelines for the sampling and analysis program conducted as part of the site assessment.

This 4.4-acre (estimated) site was purchased from the Benjamin Moore Company in 1962 and current operations were started in 1963. The facility has been primarily used for bulk storage and repackaging since that time; however, from 1969 to 1984, anhydrous ammonia was processed to ammonia.

Approximately 125 different products are handled at the facility, mostly solvents. The general categories of chemicals include:

- o Aromatic hydrocarbons
- o Aliphatic hydrocarbons
- o Petrochemicals
 - Alcohol
 - Chlorinated solvents
 - Esters
 - Glycol
 - Glycol ether
 - Glycol ether esters
 - Ketones
 - Surfactants
 - Plasticizers
 - Silicones.

The site includes a packaging facility in the northern portion of the property, a driveway area and parking lot with a tank truck loading terminal, and an oil/water separator unit about 40 feet east of the terminal. The property is bounded by Noes Creek to the south, New Jersey Branch railroad tracks to the west, Roosevelt Avenue to the east, and the now or former Wheeler Condenser and Engineering Company to the north. An additional railroad track spur extends from the southwest to the northeast through the facility.

2.0 FIELD INVESTIGATION

2.1 EMERGENCY RESPONSE FIELD ACTIVITIES

Union Chemicals requested emergency response assistance on June 26, 1985 to contain product entering Noes Creek from a seep (Seep 1) south of the plant area (Figure 2). IT responded to their request to contain and collect seepage by placing a number of absorbent booms, both up- and downstream, across the creek, placing absorbent packs into sumps hand dug at the seep, and by excavating a suspect drain pipe found at the point of the seep. The excavation continued from the original point of the seep to just north of the concrete curb where a large pit was excavated. Product was observed seeping into this pit at several locations. A vacuum truck was used to collect the product and associated contaminated water which was then pumped into Union Chemicals storage tanks on site. Soil and water samples were collected from the area of the seep and analyzed for xylene, toluene, and benzene (Tables 1 and 2). A second seep was observed during these field activities approximately 60 feet east of the first seep (Figure 2). A sump was dug at the point of this seep

and packed with absorbent material. The second seep prompted additional investigation to better define the existing problem.

Four test pits were excavated along the southern perimeter curb of the parking lot and driveway (Figure 2). During excavation of Test Pits 1, 2, and 3, product was observed seeping from the subsurface soil walls. One composite soil sample was collected from each of the four pits. Samples from Test Pits 2 and 4 were analyzed for volatile organics compounds (Table 2). A water sample was also collected from the bottom of the vacuum truck (Table 1). Soil classifications for these pits are presented in Appendix A.

The results of analyses from soil and water samples collected during the emergency response and additional investigation activities were used to design the work plan for the site assessment described in the following sections of this report.

2.2 DRILLING AND SOIL SAMPLING

Thirteen six-inch-outside-diameter soil borings were drilled to selected depths through surface fill and into natural subsurface soils (Figure 2). Soil samples were collected continuously from the borings using a two-inch-outside-diameter split-barrel sampler which was decontaminated between samples using detergent followed by clean rinse water. The sampler was driven ahead of the augers by a 140-pound hammer dropped 30 inches to provide Standard Penetration Test data (American Society for Testing and Materials [ASTM] Procedure D1586). Soil sample composites were collected from each two-foot interval starting at the ground surface. The soil samples were placed in clean, 500-milliliter, sealed amber glass jars. Two 40-milliliter volatile organic analysis (VOA) vials were also collected for each sample. Head space measurements for volatile organics were made from the jars with an organic vapor analyzer (OVA) to assist in characterizing soil contaminant levels (Table 3). All soil samples were shipped with appropriate chain-of-custody forms to the IT laboratory in Export, Pennsylvania for analysis and archiving. A log describing both the visual classification of the soils and drilling conditions was prepared by the IT field geologist (Appendix A). Drill cuttings and other wastes were drummed upon completion of each hole and properly disposed of later with other wastes derived from the initial emergency response activities at the Waste Conversion landfill.

2.3 MONITORING WELL INSTALLATION AND DEVELOPMENT

Monitoring wells were installed in 12 of the borings to allow ground water samples to be collected for chemical analysis and to provide water level information necessary to assess the direction and rate of ground water flow. The wells were constructed of two-inch-inside-diameter Schedule 40 stainless steel pipe with flush threads and 0.010-inch slotted stainless steel screens. A filter pack of coarse silica sand was placed in the annulus around each well screen and a bentonite seal was installed above the filter pack to impede the infiltration of surface water into the well. The remaining annulus between the borings and riser pipes was then grouted to ground surface with a mixture of cement and bentonite. A locking cap was installed on the riser pipe and eight-inch steel lamp hole covers were cemented in place around the riser pipe and set level with the ground surface. Well completion diagrams are presented in Appendix B.

The wells were developed by pumping with a diaphragm pump and flushing to remove fines from the area around the sensing zone to enhance communication between the water-bearing zone and the well. All water collected from the wells was placed in drums and later transferred to the Union Chemicals on-site storage tanks. All downhole well completion equipment was decontaminated between holes with hexane washes and distilled water rinses. The decontaminating fluids were collected and placed in the Union Chemicals on-site storage tanks.

2.4 MONITORING WELL ELEVATION AND LOCATION SURVEY

A survey was conducted of the installed monitoring wells by Goodman, Allgair, and Scott, a local, registered surveyor, to provide both vertical and horizontal control for water levels, samples, and geologic data. The Union Chemicals facility itself is surveyed horizontally to the New Jersey State Plane Coordinate System and vertically to the U.S. Geologic Survey elevations. Well locations and pertinent elevations are shown in Figure 2 and Table 4, respectively.

2.5 WATER LEVEL MEASUREMENT

Measurements of ground water levels in the monitoring wells were taken on three different dates and at five different times (Table 5). The water levels

were obtained at varying times in an attempt to define ground water gradients at the site under varying tidal conditions. It was concluded, however, that proper evaluation of the tidal influence on the site ground water gradient would require installation and operation of several continuous water level recorders for a period of at least two weeks.

2.6 GROUND WATER SAMPLING AND ANALYSIS

Water samples were collected from each of the monitoring wells using a 1.05-inch-outside-diameter point source bailer. The samples were collected in order from the cleanest wells to those with the greatest accumulation of product. The sampling method was designed to determine whether or not volatile organic contaminants were stratified in the aquifer. Samples were collected separately from the top and bottom of the water column in Wells 5, 6, 8, 9, 10, and 11. Only the top of the water column was sampled in the remaining wells. The monitoring wells were not purged immediately prior to collecting samples to avoid disturbing any stratification of dissolved contaminants in the aquifer or the formation of free-phase product layers. Free-phase product was observed in Monitoring Wells 5, 6, and 8 at the top of the ground water table. Sample temperature, pH, and specific conductance were measured and recorded for each sample in the field. Ground water samples were placed in appropriate sealed containers with appropriate chemical preservatives and cooled to wet ice temperature (4 degrees Celsius) for delivery to the IT analytical laboratory. Chain-of-custody forms were completed and shipped with the samples. The bailer was decontaminated between wells with hexane and distilled water which was collected and placed in the Union Chemicals on-site storage tanks.

All samples were analyzed for volatile organic compounds. Samples from Wells 1, 5, 8, and 12 were analyzed for chloride, sulfate, and alkalinity. The results of all analyses are presented in Table 6.

2.7 HYDRAULIC CONDUCTIVITY TESTING

In situ rising head permeability tests were conducted in Monitoring Wells 1, 4, 6, 7, and 12 following ground water sampling to determine well sensitivity (degree of communication between the well and the water-bearing zone) and the hydraulic conductivity of the water-bearing zone. The tests were conducted by

lowering the water level in the well below the ground water table and measuring the subsequent rise in water level as a function of time. The results of the permeability testing are presented in Table 7.

2.8 STREAM SEDIMENT SAMPLING

Two sediment samples were collected from Noes Creek (a low gradient tidally influenced stream); one from sediments upstream of the plant and the second from sediments downstream of the plant (Figure 2). The purpose of collecting these samples was to provide a preliminary determination of the plant's impact on Noes Creek sediments. The samples were collected with a hand trowel at the surface of the stream bottom sediments. Samples were placed in clean, amber glass jars and shipped to the IT laboratory for analysis. Results of the analysis are presented in Table 8.

3.0 RESULTS OF INVESTIGATION

3.1 SITE GEOLOGY AND HYDROGEOLOGY

The Union Chemicals facility is constructed on relatively level fill material emplaced on irregular, unconsolidated sedimentary deposits. Cross sections were constructed from the borings logs and are presented in Figures 3, 4, and 5. The locations and orientations of the sections are shown in Figure 2.

Fill deposits range in thickness from zero to at least 15 feet beneath the site and are composed of fine to coarse sands with some gravels, clay, bricks, concrete, metal, glass, and slag. Beneath the fill are irregular deposits of sands, clays, silty clays, silt, and peat. It appears that older sand and clay deposits have been partially eroded and the depressions filled in with younger deposits of peat, clays, and sands. This reworking of sediments was probably the result of meandering and ensizing by Noes Creek.

Ground water elevation data were collected at five different times and tidal stages (Table 5). The data show fluctuating water levels which may be associated with tidal changes. The total change in ground water level and lag time at each well due to tidal influence cannot be determined from the present data base. It may be necessary to install and operate several continuous ground water level recorders for a short time period to obtain the data required for evaluation of remedial action alternatives.

Generally, the ground water flows from north to south across the site (Figure 6). The water table contours were developed from the average of the last four water level measurements, excluding deeper Wells MW-7 and MW-2.

Water levels in two well groups, MW-1 and MW-2 and MW-6 and MW-7, show a downward ground water gradient in the sediments. The gradient is slight but consistent at these two sites. Actual vertical gradients may be greater beneath the site; the measured magnitude is likely reduced from actual conditions by the size of the sensing zone established by the long length of screen in the wells.

Permeability test results indicate that the fill, sand, and clay deposits have low to moderate hydraulic conductivities (Table 7).

Assuming an average ground water gradient of 5 feet/330 feet, an average hydraulic conductivity of 3×10^{-5} feet per second (9×10^{-4} centimeter per second), and a porosity of 0.4, the average ground water velocity was calculated to be about 1×10^{-6} feet per second, or about 32 feet per year. This value was calculated using the following equation:

$$V = \frac{ki}{\theta}$$

where

k = average hydraulic conductivity,

i = average horizontal ground water gradient perpendicular to the direction of ground water flow, and

θ = assumed representative porosity.

3.2 ANALYTICAL RESULTS

Elevated concentrations of volatile organics were detected in water and soil samples during the initial emergency response program (Tables 1 and 2). Additionally, free product was observed flowing into Test Pits 1 through 3 and at the water table in Monitoring Wells 5, 6, and 8. Water samples collected from seeps contained 8,200 parts per billion (ppb) benzene, 7,700 ppb toluene, and 100,000 ppb total xylenes. Soil samples collected from the area adjacent to the seep had a benzene concentration of 200 ppb and total xylenes of 440 ppb.

Table 2 also indicates the levels of volatile organics which were detected in soil samples from Test Pits 2 and 4. Test Pit 2 evidenced higher concentrations of all parameters analyzed than Test Pit 4, with the exception of ethylbenzene and total xylenes. The Test Pit 2 soil sample contained significant concentrations of:

- o Chlorobenzene
- o Methylene chloride
- o Tetrachloroethylene
- o 1,1,1-trichloroethane
- o Acetone
- o Total xylenes.

The Test Pit 4 soil sample contained significant concentrations of chlorobenzene and total xylenes.

During the drilling operations, head space measurements of volatile organics were conducted on soil samples which had been placed in glass jars. The results of the measurements indicate that organic materials are present throughout the sampled soil columns (Table 3). The type of OVA used for these determinations was of the ionization type so that methane gas, if present, did not influence the readings.

The ground water collected from the 12 monitoring wells was analyzed for all volatile priority pollutants and selected volatile nonpriority pollutants. Table 6 is a summary of pollutants detected in the water samples. The significant contaminants appearing on this list which have the potential for the greatest health risk are:

- o Benzene
- o Chlorobenzene
- o Methylene chloride
- o Tetrachloroethylene
- o Trans-1,2-dichloroethylene
- o 1,1,1-trichloroethane
- o Trichloroethylene.

Significant (greater than 100 ppb) concentrations of these contaminants were found in Monitoring Wells 4 through 11.

Volatile organics were not detected in the sediment samples collected from Noes Creek.

4.0 QUALITATIVE RISK ASSESSMENT

4.1 INTRODUCTION

A hydrogeologic investigation of the Union Chemicals site located in Carteret, New Jersey has indicated the presence of several volatile organic chemicals in the ground water beneath the facility. This qualitative risk assessment will provide a preliminary appraisal of the health risks and environmental impacts associated with exposure to those chemicals in site-specific circumstances.

The fundamental concept of the risk assessment stipulates the requirement of a hazard and an exposure to that hazard before a health risk or environmental impact can occur. A completed exposure pathway is inferred, which includes three necessary components: (1) a source--the presence of contaminants having known toxicological characteristics; (2) an exposure pathway--actual or potential pathways that are complete; and (3) receptors--human and environmental receptors in the exposure paths. The hydrogeologic study has established the presence of the hazardous constituents and provides preliminary data to evaluate the potential exposure pathways.

High levels of monocyclic aromatic hydrocarbons (benzene, chlorobenzene, ethylbenzene, toluene, and xylene) and halogenated aliphatic hydrocarbons (tetrachloroethylene, 1,1,1-trichloroethane, and vinyl chloride) were detected in site ground water and surface seepage samples. A nonaqueous phase liquid (NAPL) flow condition, evidenced by the presence of a product layer above the aqueous fraction of the seeps and ground water samples, was observed during the emergency response and hydrogeologic investigation phases of this project.

Based on the geographical and topographical distribution of potential human receptors and environmental biota, a preliminary estimate would indicate a low potential for human exposure and a high possibility of impacts on environmental biota, to the extent they are present in Noes Creek and the Arthur Kill.

4.2 CONTAMINATION CHARACTERIZATION

The contamination pattern of volatile organic constituents found on site can be characterized by the presence (or absence) and concentrations of selected indicator chemicals in the individual environmental media samples and by evaluation of the spatial distribution of contaminants.

Volatile organic contamination of ground water was chosen as the primary site investigation focus due to the following:

- o The bulk of the materials handled at the facility and the materials known to have been released in the past or detected in ground water during the emergency response phase of the project are volatile organic compounds.
- o Volatile organic compounds are generally highly mobile in soils due to high volatility (as indicated by vapor pressure), have high water solubility, and low capacity for soil adsorption (soil adsorption coefficient); therefore, permanent soil and sediment contamination by volatile organics should be minimal as compared to current levels of ground water contamination.

4.2.1 Probable Contaminant Source

High concentrations of volatile organic chemicals were found in the ground water and seeps (aqueous and nonaqueous fractions) collected at the site. The observed pattern of contamination and the resulting hypothesized sources depend to some extent on the placement of the monitoring well. This dependence results from the necessity to infer contamination patterns between the monitoring wells.

It appears that past spills and leakage has occurred from the tank farm located in the northwest section of the site. Monitoring Well 12 is an on-site upgradient well that has some utility as the background descriptor. Monitoring Wells 1 to 3 may also be monitoring background water quality, or are located outside of the contaminant plume. The ground water in these wells does not appear to be impacted at the present time. Major chemical constituents in the contaminated ground water plume emanating from the tank area are monocyclic aromatic hydrocarbons (MAHs). Indicator constituents in this category are benzene, chlorobenzene, ethylbenzene, toluene, and xylene.

Halogenated aliphatic hydrocarbon (HAHs) display a different distribution pattern among the analyzed samples and the location of the sampling points. They appear to have emanated from the tank farm in the center of the Union Chemicals facility. This is based on the absence of these particular contaminants in the ground water in the vicinity of the northwest tank farm. The HAHs selected as indicator chemicals for this site are tetrachloroethylene (PCE), 1,1,1-trichloroethane commonly known as methyl chloroform (MC), and vinyl chloride (VC) probably resulting from biodegradation of the PCE.

It must be emphasized that the above conclusions relating to the probable sources are based on limited background information and a small chemical analytical data base.

4.2.2 Characterization of Extent of Contamination

This description of the extent of contamination is intended to provide a framework for assessment of exposure to hazardous constituents migrating from the site. Since the chemical analytical data base is essentially limited to volatile organic contaminants detected in the ground water, the character of the other environmental media, i.e., ambient air (on and off site); soils (surficial and subsurface), in the unsaturated and saturated zone; surface water in Noes Creek and Arthur Kill; and creek sediments, cannot be directly evaluated. Appraisal of the likely extent of contamination of these environmental media is based on the limited background information and site investigation data available.

Ambient Air

The quality of on-site ambient air is unknown. However, the presence of volatile organics at relatively high concentrations in the ground water, the very shallow unsaturated zone above the ground water table which potentially provides a link between the air and ground water through capillary action, and contaminated seeps on site would indicate some impact on ambient air quality.

Volatile organic constituents are volatilizing from ground water, possibly contaminated soils (actual levels are unknown; high OVA readings were observed during soil disturbance when excavating the test pits) and contaminated surface waters of Noes Creek. The ambient air levels of benzene are probably

elevated above background and could be at concentrations on the site that pose some risk upon exposure. All of the other contaminants, i.e., chlorobenzene, ethylbenzene, toluene, and xylene, will most likely also be elevated above background levels but are not expected to reach concentrations associated with health risks. None of the HAHs, although they will volatilize, are expected to be present above background levels. Vinyl chloride will evaporate readily at ambient temperatures, but detectable incremental elevations in concentrations are not likely due to the low levels detected in site ground water.

Undetermined semivolatile organics and inorganic constituents, if any, would not volatilize to the extent necessary to impact ambient air quality.

Soils

There is only a very limited chemical analytical data base available to estimate the extent of soil contamination. Based on the behavior of chemicals in the environment, the list of chemical products handled at this facility, and the presence of a NAPL flow condition, the following limited characterization may be applicable to this site:

- o Presence and levels of volatile organic contaminants (found in the ground water) in the soils will be limited unless bulk dumping has occurred in the past or there is an ongoing contaminant release. Volatile organics are highly mobile in soils due to their ability to evaporate to air, high solubility in water, and low soil adsorption capability.
- o Phthalate esters, polycyclic aromatic hydrocarbons (PAHs), and halogenated ethers may be present at significant levels in the soils in the unsaturated and saturated zones. The reported product mix and presence of a nonaqueous fraction (which is mainly organic solvents) would enhance the mobility of these relatively immobile chemicals in the soil and water media. However, there are no data available to determine the validity of this premise.

Ground Water

There appears to be both vertical and horizontal migration of the volatile organic constituents found in the ground water. This is likely due to the behavior of these particular chemicals in the environment. Vertical stratification of contaminants in some of the wells is apparent; lower specific

gravity compounds were found in higher concentrations in samples taken from the top of the well. This may be due to gravity separation or could be due to a mixing of the NAPL solution in the upper sample.

The lighter MAHs appear to have migrated from the northwest tank area. The highest concentrations were found downgradient at this area in Monitoring Wells 6 and 8. Benzene and chlorobenzene were observed at the highest concentrations (benzene at 85,000 micrograms per liter [$\mu\text{g}/\text{l}$] maximum; chlorobenzene at 230,000 $\mu\text{g}/\text{l}$ maximum) and with the highest frequency (15 positive detections in 16 samples). Only the MAHs (benzene, chlorobenzene, ethylbenzene, toluene, and xylene) and methyl chloroform have moved to the deeper part of the aquifer as indicated by the analytical results from the Monitoring Well 7 deep well sample.

The contaminant plume appears to be confined to a relatively limited area. Monitoring Wells 1 through 3 do not appear to be in the influence of the plume at this time.

Relative to potential exposure to contaminated ground water, it should be noted that:

- o The dominant ground water flow direction is toward Noes Creek and Arthur Kill. This is away from the greatest concentration of human receptors located northwest of the site. Consequently, the potential for exposure to significant levels of volatile organic pollutants in ground water by ingestion is very low. This premise is valid whether the ground water is or is not being used for drinking purposes. There are, however, no known users of shallow ground water in the area of the site.
- o Because there are no available data regarding semi-volatile organics that may be present in the ground water due to the NAPL conditions, the potential impacts due to ground water discharge to surface water cannot be evaluated.

Surface Water

There is a very limited available data base to characterize the contamination of surface water, i.e., Noes Creek and Arthur Kill. Seeps and ground water accumulated in the test pits are defined as ground water for the estimation of

health risks and environmental impacts. Evaluation of surface water quality was not an objective of the first phase of the hydrogeological study.

A clear understanding of the environmental fate of the site contaminants is essential for estimating health and environmental impacts. The volatile organics in the ground water will be essentially volatilized at the surface water/ambient air interface. The most likely potential impacts on environmental and human receptors will be from migration of semivolatile organic pollutants in the nonaqueous fraction of contaminated ground water to both surface water and sediments. Semivolatiles that are solubilized in the nonaqueous phase could adsorb to colloidal particles in surface water and settle to the bottom in the sediments. There, they would be available to aquatic biota if biota are present. Some toxic constituents, i.e., PAHs, if they are present, could move up the food chain by bioaccumulation and biomagnification to result in significant potential exposure.

The extent of surface water contamination is unknown. Attenuation of volatile organic contaminants by evaporation and the unlikely possibility of impacted surface water being used as a potable water source (it may be brackish or sea water) may preclude exposure by human receptors. Transfer of volatile organics to ambient air is not expected to result in significant levels due to the great opportunities for attenuation by advection and dispersion in the open atmosphere.

4.3 EXPOSURE PATHWAYS

An exposure pathway is the route a contaminant may take to reach a susceptible receptor. For an exposure pathway to be complete, three factors must be present: a source of contamination, a route of contaminant transport, and an exposure of an environmental or human receptor to the contaminants. The mode of exposure and its duration also influence the impacts. Modes of exposure are usually categorized as inhalation, ingestion, and dermal (direct contact). There may be indirect exposures by ingestion of contaminated foods and by dermal and inhalation during recreational use (wading, fishing, and boating) of surface waters. Exposure durations are separated into two main classes, i.e., acute, which is of short duration and frequency, and chronic, which implies long-term (months and years) and continuous or frequent exposure.

4.3.1 Ambient Air

All of the detected contaminants are volatile organic constituents; consequently, all will evaporate at the soil/air and surface water/air interface to result in incremental increases in levels above background. The only potential exposure to toxicologically significant levels of the most critical contaminant (benzene) will be on site. Advection and dispersion would attenuate vapor concentrations to safe levels at the nearest off-site human receptor locations.

4.3.2 Soils

Surficial Soils

The relatively difficult access to the industrial area in which the site is located (the presence of a railroad track and perimeter fencing separating the residential area from this site) will minimize the trespass of children and third-party intruders. Consequently, only on-site personnel will be considered to be the potential receptors due to direct contact with or ingestion of contaminated surficial soils. Therefore, direct contact with contaminated surface soils is not considered to be a potential exposure path.

Subsurface Soils

Exposure to contaminants that may be present in the deep soils by direct contact is not expected to be a viable exposure pathway. Deep soils may serve as a conduit to transport volatile organics, and potentially semivolatile organics mobilized in the NAPL, to ground water.

Migration of volatile organics from the unsaturated zone to ambient air will elevate ambient air concentrations, but significant concentrations are not expected on site and are very unlikely at any off-site receptor location.

4.3.3 Ground Water

Ingestion of contaminated ground water is not expected to be a critical exposure path at this site. All of the ground water beneath the site is flowing away from the closest cluster of homes (supplied by a city water system). Ground water discharges from the site into Noes Creek very rapidly reach Arthur Kill. Both bodies of water are subject to salt water intrusion making local surface water an unavailable source of potable water for the nearby residents.

Indirect exposure to some contaminants, if the volatile organics are not attenuated, during recreational use of Arthur Kill is possible. However, the industrial character of the surrounding area and the presence of a large active landfill and marsh on the Staten Island side of the Kill would deter recreational use of the surface water in the impacted area.

4.3.4 Surface Water

Surface waters may be impacted. There are no available data to determine whether volatile organic contaminant attenuation is occurring. If semivolatile organic constituents are entering the Creek and Kill they would accumulate in the bottom sediment. Consequently, there could be some potential for uptake in the food chain with subsequent exposure of human receptors due to ingesting contaminated aquatic food. The volatile organics do not bioaccumulate to any great extent. The most likely exposure path would be associated with semivolatiles that may be mobilized in the NAPL and transported by ground water discharges and surface seeps to Noes Creek.

4.3.5 Environmental Impacts

The most toxic class of contaminants in the context of aquatic toxicity is the inorganic constituents. This does not appear to be a problem at this site. The low conductivity of the ground water samples is indicative of low dissolved solids and an absence of ionic activity in the water. Volatile organics will be attenuated due to evaporation of the surface water/air interface. In addition, most of them are not acutely or chronically toxic to aquatic biota at the expected surface water concentrations. The introduction of pollutants from the landfill that have high associated biological and chemical oxygen demand may affect the dissolved oxygen levels in the creek and Arthur Kill to result in adverse effects on the aquatic biota (if they are present).

4.4 RECEPTORS

The following potential human receptors may be present in the vicinity of the site:

- o Users of ground water for drinking purposes - None known in the area surrounding the site

- o Users of surface water for recreational purposes -
Dermal exposure during swimming and boating (inadvertent dermal exposure) and inhalation of volatilized organics
- o Persons trespassing on site and coming in direct contact (dermal exposure) with contaminated soils and ground water (seeps) on site
- o Persons coming in contact with contaminated sediment and surface soils that may have migrated off site in surface runoff
- o Persons inhaling volatilized organic vapors that are mobilized by wind erosion
- o Persons consuming contaminated aquatic food that has bioaccumulated and biomagnified contaminant levels.

Environmental receptors include:

- o Aquatic biota that are exposed to organic contaminants with associated bioaccumulation and biomagnification characteristics
- o Surface waters that may be adversely affected to limit their use for any purpose
- o Wetland and marsh ecologies that are very fragile and will be adversely altered by introduction of chemical contaminants.

The identification and characterization of the above receptors was not an objective of the first phase of this investigation. Based on the topographical and geographical character of the site and the surrounding area, as interpreted from the USGS map, the presence of the above receptors at locations where significant impacts may be possible is not a high probability at present or at some future time.

4.5 HAZARD IDENTIFICATION

The identification and characterization of hazards associated with the site is based on the presence and concentration of chemicals found. Consequently, this hazard characterization is based on volatile organic compounds detected in the ground water beneath the site.

The following criteria are used to select the indicator contaminants for the risk assessment:

- o Toxicity - If the contaminant has associated biological health impacts, i.e., carcinogenicity or development effects, it should be included as a contaminant of concern. Acute and chronic systemic toxicity has an implied threshold level; consequently, other criteria must be used in conjunction with toxicity.
- o Concentration levels - Constituents detected at high concentrations in the environmental media should be included if they are prevalent.
- o Prevalence is defined by the frequency of positive detections in the collected samples and the character of the contamination pattern.
- o Persistence in the environment.

Table 9 provides a summary of the pertinent factors for categorizing the detected contaminants.

Benzene, vinyl chloride, and PCE are classified as suspect animal or human carcinogens. They were found frequently, especially benzene, in the ground water samples at significant concentrations. Consequently, all were included as indicator contaminants.

Ethylbenzene, toluene, methyl chloroform, and xylene, which have exhibited systemic toxicity with associated thresholds, were detected frequently to indicate a high prevalence in the ground water. They were selected as indicator contaminants for the risk assessment.

Chlorobenzene was classified as an indicator chemical due to the very high concentrations found on site. Since it does not possess any toxicological properties, it was considered to be a precursor of benzene and xylene and was used to define the extent of contamination.

Although chloroethane was frequently detected in the ground water samples and the maximum concentration of 1,600 µg/l was considered to be an anomaly (the next highest value was 67 µg/l) the concentrations are not considered to be significant. This evaluation is based on the low toxicity of this compound by

the ingestion route and its chemical nature, i.e., it is a gas at normal temperatures. 1,1-dichloroethane and 1,2-trans-dichloroethylene were also detected frequently. However, at the concentrations measured exposure is not likely to cause a health impact.

Ketones (acetone, 2-butanone [methylethyl ketone]) and styrene were found less frequently. However, at the reported concentrations, exposure is not expected to result in any adverse health impacts due to the relatively low systemic toxicity of these compounds.

4.6 EXPOSURE ASSESSMENT

As explained in the previous sections, there is no existing exposure of receptors to the site contaminants due to hydrological and geographical factors. Vapors and airborne particulates are not expected to reach off-site human receptors in significant concentrations. Additionally, the population in close proximity to the site is served by a municipal water system and the direction of contaminated ground water migration is directly away from the closest off-site human receptors. Thus, they are not located in potential exposure pathways. Ambient air and ground water contaminant concentrations will be reduced to insignificant levels by the time they reach the nearest downwind and downgradient human receptor.

If sensitive ecological systems are in the exposure pathway, i.e., marsh and wetland habitats, there could be some potential degradation or alteration of the biotic communities.

Presence or absence of environmentally persistent contaminants has not been established. The above exposure assessment is based only on the available chemical analytical data, hydrological data developed in this phase of the investigation, and an interpretation of the U.S. Geological Survey topographic map of the area.

4.7 RISK CHARACTERIZATION

Due to hydrological and topographical factors, and spatial distribution of possible receptors, the site does not appear to pose any health risks. There is some potential for environmental impacts on aquatic and terrestrial biota if fragile ecological habitats are located in the area.

It should be noted that this assessment is based on minimal data. This investigation did not attempt to fully identify and characterize the extent of contamination, particularly in areas adjacent to the site.

Data gaps which would have to be addressed should a comprehensive risk assessment be required include analysis of semivolatile organic compounds, identification of specific receptors, and analysis of specific potential environmental impacts.

5.0 GENERAL RESPONSE ACTIONS AND REMEDIAL TECHNOLOGIES

The purpose of this chapter is to discuss the General Response Actions and possible Remedial Technologies that may be used at the Union Chemicals site to mitigate the existing contamination problem. Although the initial qualitative risk assessment concludes there are no apparent risks to human health associated with site contaminants, it may be necessary to implement a remedial action at the site to mitigate contamination of environmental media, i.e., ground water, Noes Creek, and Arthur Kill, and/or to protect aquatic ecosystem downstream of the site. It is currently anticipated that the remedial technologies that will be evaluated and screened prior to developing remedial action alternatives would focus primarily on reduction of ground water contaminant levels and control of contaminant migration and discharge to Noes Creek. Additional remedial technologies, i.e., those relative to soil contamination, are discussed here for completeness.

5.1 CONTAINMENT

The remedial action technologies that will be evaluated under the Containment General Response Action include the following:

- o Capping specific site areas
- o Ground water barriers.

5.1.1 Capping Specific Site Areas

Capping would reduce surface water infiltration rates and also prevent the spread of contaminants by wind and surface water runoff, as well as provide a cover over the contaminated areas preventing direct contact by potential receptors. Capping methods may include the placement of clay and synthetic membranes along with a vegetated top cover over specific site areas.

5.1.2 Ground Water Barriers

Ground water barriers would decrease the rate of contamination migration from the site. These barriers include soil-bentonite or cement-bentonite slurry walls. Slurry walls may be constructed upgradient of the site to divert ground water flow, downgradient of the site to facilitate capture of contaminated ground water, or as a complete perimeter barrier to ground water flow. The success of these barriers depends on the constructors ability to construct a solid slurry wall of high integrity, the ability to key the slurry wall into a relatively impermeable formation at the bottom, and the compatibility of the slurry wall materials with the contaminants.

5.2. GROUND WATER PUMPING

Ground water pumping is a remedial technology that can be used alone, or in combination with capping, ground water barriers, and ground water treatment. It can be designed to simply limit the migration of the contaminant plume while removing contaminated ground water, or with recycling to provide for flushing of contaminants from both saturated and unsaturated soils.

Ground water pumping systems are developed and evaluated to optimize removal of contaminated ground water. Typical ground water pumping systems include a system of well points manifolded to a common pump or individual larger diameter interceptor wells. The well design optimizes the well location and spacing based on hydrogeologic conditions to maximize the total contaminant production for recovery and/or treatment.

The pumping system delivers contaminated ground water to an on-site or off-site treatment system for treatment prior to discharge or injection of the treated water back into the aquifer. The feasibility of designing and constructing an on-site treatment system will be evaluated as well as an evaluation made relative to pumping or hauling contaminated ground water to an approved off-site treatment facility, i.e., Publicly Owned Treatment Works (POTW) and/or a privately owned treatment system.

5.3 COLLECTION SYSTEMS

Remedial technologies that would be evaluated under the Collection System General Response Action would include:

- o Large diameter wells (receptor wells)
- o French drains
- o Open cut trench with pumping network.

5.3.1 Large Diameter Receptor Wells

Large diameter receptor wells would utilize gravity separation of ground water and free product in wells 12-inch to 36-inch in diameter. The system would employ a number of large diameter wells placed strategically over the site. Each system would include a submersible pump for lowering the water table and a scavenger pump that would retrieve the light organic fraction floating on the ground water surface. The water would be pumped to a treatment system and the product captured would be transferred to a recovery unit or storage tank for transport off site.

5.3.2 French Drains

French drains outfitted with collection sumps and pumps could be installed along the perimeter of the site to capture and remove contaminated ground water.

French drains are constructed by excavating a trench, lining the trench with a geotextile filter fabric, and backfilling the trench with gravel. Ground water flows into the drains and is conveyed to a collection sump for transport to a treatment system. Perforated pipe can be placed in the bottom of the trench to provide a more effective conduit for ground water flow and ultimate removal of the contaminated ground water.

The site topography, ground water elevations, depth of excavation, and in-situ soil permeability will require a thorough evaluation in determining the feasibility of using french drains as a remedial technology.

5.3.3 Open Cut Trench with Pumping

This remedial technology is similar to the french drain system except that the excavated trench will remain open for ease of operation and observation during pumping.

The relative advantages to this remedial technology is that there is no requirement for filter fabric, gravel backfill material, or perforated pipe. The feasibility of utilizing this method of ground water removal will depend to a large extent on the constructibility of the trench, the length of time the trench will have to remain open relative to personnel safety, and the depth of the trench.

5.4 DIVERSION

The Diversion General Response Action includes the evaluation of the following remedial technologies:

- o Grading and revegetation
- o Control of surface water.

5.4.1 Grading and Revegetation

Site grading would be considered. This would be to provide a uniform land surface that promotes good surface water drainage from the site areas.

Revegetation would consist of placing top soil, as necessary, seeding and mulching to establish a suitable vegetated growth media on the newly graded area. This would stabilize the soil cover and prevent wind and soil erosion caused by water.

5.4.2 Control of Surface Water

Surface water control would consist of controlling storm water run-on and runoff from the site area by placing collection and diversion channels at strategic site locations to collect surface run-on. Surface water control directly reduces the volume of water available for infiltration into the site, ultimately reducing the migration rate of contaminated ground water. It also reduces the chance of contamination migration caused by surface runoff.

5.5 COMPLETE REMOVAL

Complete removal is simply the physical removal of all contaminated soil from the site. The excavated material would be loaded onto trucks and hauled to an approved treatment and/or disposal facility.

5.6 PARTIAL REMOVAL

Partial removal of contaminated soil would be evaluated. This remedial technology can be used to selectively remove contaminated "hot spots," (areas which contain contaminants in excess of specified levels).

5.7 ON-SITE AND OFF-SITE TREATMENT

The on-site and off-site treatment technologies that will be evaluated would include:

- o Incineration
- o Biological treatment
- o Physical treatment methods.

5.7.1 Incineration

Contaminated soils can be decontaminated by incineration. Incineration, using a rotary kiln, is a proven but expensive technology for destroying organic materials by high temperature combustion. The organic contaminants most amenable to incineration are the volatile compounds. Incineration of contaminated soils may be accomplished on site using a mobile incinerator unit. Off-site incineration would require transportation of the contaminated soils to a licensed incinerator capable of handling the decontaminated soil.

5.7.2 Biological Treatment

Biological treatment would be evaluated relative to treating the contaminated ground water that would be collected. The contaminated ground water may be able to be introduced into biological wastewater treatment units where microorganisms would assimilate the organic compounds and use them as a food substrate. The organics would be converted to a more stable inorganic form or to cellular biomass. Biological treatment may also be designed and implemented as an in situ operation.

This treatment technology may be used in combination with a physical treatment process such as air stripping, steam stripping or activated carbon adsorption.

5.7.3 Physical Treatment Methods

The physical treatment technologies that will be evaluated for possible use in treating the contaminated ground water would include:

- o Equalization
- o Air stripping
- o Steam stripping
- o Activated carbon adsorption.

5.7.3.1 Equalization

Equalization would be used to dampen flow and/or concentration fluctuations. Typically, treatment processes operate more effectively if wastewater composition and flow rate are fairly constant. Equalization basins and/or tanks increase the stability of treatment processes especially if they are sensitive to fluctuating contaminant concentrations. Such treatment processes include activated carbon adsorption and biological treatment. The only disadvantage is that an equalization basin, when used to dampen fluctuations in the flow rate, may require a large area or tank to handle peak flows.

5.7.3.2 Air Stripping

Air stripping is an effective method for removal of volatile organic contaminants from ground water. The volatile compounds are stripped from the water when large volumes of air are passed upwards through a packed column, while the contaminated water flows counter current over the packing material. While effective volatile contaminant removal is experienced with the use of this technology, inorganic and nonvolatile organic constituents remain untreated. The use of this process treatment technology would most likely require additional process treatment steps to further treat the contaminated water to specified concentration levels.

5.7.3.3 Steam Stripping

Steam stripping is a proven process which is generally used for removing volatile organic compounds from process or wastewaters. Steam stripping is typically conducted as a continuous operation in a packed tower or fractionating distillation column. As the contaminated ground water passes down through the column, it contacts the vapors rising from the bottom of the column where the contaminated ground water is finally heated by the incoming steam to reduce the volatile components in the water.

Steam stripping would have to be compared technically and economically to air stripping to determine the relative efficiencies and costs of each. This

evaluation would be based on the ground water contaminant levels and degree of treatment that would be required.

5.7.3.4 Activated Carbon Adsorption

The activated carbon process has been widely used to remove a large number of organic contaminants. Carbon adsorption would involve contacting the contaminated ground water with activated carbon, which adsorbs the contaminants in the water. When the carbon reaches its ultimate capacity for adsorption, it is removed from the containment canisters for disposal, destruction, or regeneration.

The suitability of carbon adsorption for the treatment of contaminated ground water will depend on the type of contaminants, the extent of pretreatment necessary, and the required effluent quality.

Activated carbon has been proven effective for the removal of a variety of chlorinated hydrocarbons, organic phosphorus, PCBs, phenols, aromatic hydrocarbons, and some heavy metals. It is also effective for taste and odor control and color removal.

TABLES

TABLE 1
SURFACE WATER ANALYSES SUMMARY

PARAMETER	SAMPLE IDENTIFICATION		
	U-1W(a) (water layer)	U-1W(a) (oil layer)	U-4(b)
<u>VOLATILE PRIORITY</u> <u>POLLUTANTS (ppb)</u>			
Benzene	8,200	1,000,000	14,000
Chlorobenzene			37,000
Methylbromide			1,400
Toluene	7,700	3,600,000	640
<u>VOLATILE NONPRIORITY</u> <u>POLLUTANTS (ppb)</u>			
4-Methyl-2-pentanone			2,700
Styrene			690
Total xylenes	100,000	64,000,000	610

(a) Water sample collected near first seep.

(b) Water sample collected from bottom valve of vacuum truck.

TABLE 2
SOIL ANALYSES SUMMARY

PARAMETER	SAMPLE IDENTIFICATION		
	U-2S(a)	U-TP-2(b)	U-TP-4(c)
<u>VOLATILE PRIORITY</u>			
<u>POLLUTANTS (ppb)</u>			
Benzene	200	64	33
Chlorobenzene		950	650
1,1-Dichloroethane		74	-
Ethylbenzene		17	69
Methylene Chloride		160	77
Tetrachloroethylene		2,100	19
1,1,1-Trichloroethane		510	-
Trichloroethylene		85	-
<u>VOLATILE NONPRIORITY</u>			
<u>POLLUTANTS (ppb)</u>			
Acetone		240	-
Total xylenes	440	120	520

(a) Surface soil sample collected near first seep.

(b) Composite soil sample collected in Test Pit No. 2.

(c) Composite soil sample collected in Test Pit No. 4.

TABLE 3
RESULTS OF MEASUREMENTS FOR VOLATILE ORGANICS OF SOIL
SAMPLE BOTTLE HEADSPACE REGION
(PPM from OVA)

SAMPLE NUMBER	BORING NUMBER											
	B-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12
S-1	<1.0	0	3	100	100	300	>1,000	250	500	>1,000	45	>1,000
S-2	90	300	950	>1,000	450	>1,000	(a)	>1,000	>1,000	>1,000	>1,000	>1,000
S-3	100	850	>1,000	350	>1,000	>1,000	650	>1,000	>1,000	>1,000	400	>1,000
S-4	>1,000	450	>1,000	100	>1,000	(a)	240	>1,000	>1,000	>1,000	650	>1,000
S-5		110	200	420	950	>1,000	200	>1,000	>1,000	>1,000	>1,000	400
S-6		75	60	800		>1,000	45	>1,000	>1,000	900	700	
S-7		250	15			>1,000	100	>1,000	>1,000	>1,000	50	
S-8		20				>1,000	10	>1,000	250			
S-9		50				>1,000	60	>1,000				
S-10		0				0		950				
S-11		10										
S-12		50										
S-13		10										
S-14		5										
S-15		15										

(a)Insufficient sample collected to measure.

TABLE 4
MONITORING WELL ELEVATIONS(a)

MONITORING WELL	TOP OF COVER	TOP OF INSIDE PIPE	BOTTOM OF WELL
MW-1	8.98	8.27	-1.02
MW-2	8.47	7.91	-21.53
MW-3	9.31	8.87	-4.69
MW-4	9.30	8.68	1.30
MW-5	9.16	8.90	1.16
MW-6	8.84	8.60	-7.16
MW-7	8.83	8.24	-23.17
MW-8	9.43	8.82	4.57
MW-9	10.40	9.89	-4.60
MW-10	10.83	10.32	2.83
MW-11	11.25	10.70	3.25
MW-12	12.48	12.10	4.48

(a) Elevations in feet (msl).

TABLE 5
GROUND WATER ELEVATIONS

MONITORING WELL NO.	DATE/APPROXIMATE TIME				
	9-17-85/07:50(a)	9-17-85/14:20(b)	10-7-85/10:00(c)	10-7-85/16:15(d)	10-15-85/12:30(e)
1	2.69	3.10	4.52	2.52	4.89
2	3.45	3.33	4.16	2.16	4.78
3	5.45	6.24	6.54	5.87	6.56
4	5.51	5.91	6.35	6.18	6.90
5	3.15	3.65	3.57	3.40	4.80
6	3.60	4.18	4.45	3.10	4.83
7	2.86	3.16	4.16	3.24	4.70
8	4.53	5.49	5.66	5.03	5.02
9	7.39	7.89	8.31	8.16	8.46
10	6.07	8.11	8.57	8.69	8.77
11	8.20	9.20	9.91	9.89	9.47
12	8.60	9.93	10.93	10.89	10.44

(a)High tide at Sandy Hook, NJ 9-17-85 was at 09:24.

(b)Low tide at Sandy Hook, NJ 9-17-85 was at 16:00.

(c)High tide at Sandy Hook, NJ 10-7-85 was at 13:11.

(d)Low tide at Sandy Hook, NJ 10-7-85 was at 20:18.

(e)Low tide at Sandy Hook, NJ 10-15-85 was at 14:38.

Note: All elevations in feet (msl).

TABLE 6
GROUND WATER ANALYSES SUMMARY

PARAMETER	SAMPLE IDENTIFICATION																
Volatile Priority Pollutants (ppb)	MW-1T	MW-2T	MW-3T	MW-4T	MW-5T	MW-6B	MW-6T	MW-7T	MW-8B	MW-8T	MW-9B	MW-9T	MW-10B	MW-10T	MW-11B	MW-11T	MW-12T
Benzene	7.3	22	22	2,200	2,500	49,000	85,000	320	17,000	18,000	2,800	2,300	120	61	240	240	-
Chlorobenzene	17	150	41	4,200	23,000	230,000	150,000	2,000	140,000	130,000	1,500	230	13	-	310	300	16
Chlorodibromomethane	-	-	-	-	-	-	-	2.7	-	-	-	-	-	-	-	-	-
Chloroethane	-	6.8	25	1,600	55	-	4.1	-	-	-	65	67	47	38	6.6	5.9	-
Chloroform	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-
1,1 Dichloroethane	2.5	46	4.2	120	12	-	2.5	-	5.6	4.1	7.7	6.0	-	-	-	-	-
1,2 Dichloroethane	-	-	-	9.9	3.7	-	-	2.4	-	-	-	-	-	-	1.1	-	1.1
1,1 Dichloroethylene	-	8.6	-	-	-	-	-	-	1.7	1.4	-	-	-	-	-	-	-
1,3 Dichloroethylene	-	-	-	64	-	-	-	-	-	-	79	37	-	-	6.2	6.0	-
Ethylbenzene	-	-	-	280	2,700	-	2,600	230	1,400	1,800	300	44	480	-	-	-	-
Methylene Chloride	-	-	-	-	-	630	21	-	14	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	-	-	-	-	15	-	-	-	-	-	-	-	-	-	2.2	-	1.9
Tetrachloroethylene	-	1.0	-	2.8	-	200	320	-	940	1,100	-	-	-	-	-	-	-
Toluene	1.0	6.6	-	2,800	570	2,700	5,200	37	990	580	18	-	220	2.1	3.0	1.8	-
Trans-1,2 Dichloroethylene	-	2.8	1.3	62	1.0	640	74	2.4	280	220	4.6	-	-	-	-	-	-
1,1,1-Trichloroethane	-	87	54	44	-	-	4.1	450	330	280	15	110	-	-	-	-	1.4
Trichloroethylene	-	2.2	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	-	-	-	15	-	-	10	-	49	60	-	10	-	-	-	-	-
Volatile Non Priority Pollutants (ppb)																	
Acetone	-	-	-	16	28	-	-	65	22	12	17	-	-	-	-	-	-
2-Butanone	-	-	-	-	100	-	-	62	89	-	78	100	-	-	-	-	-
Carbon disulfide	13	18	-	46	-	-	-	-	-	-	-	-	48	18	-	48	28
4-Methyl-2-pentanone	-	-	-	26	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	7.6	39	-	250	-	210	180	45	-	110	-	-	-	-
Xylenes, Total	-	-	-	920	4,500	2,200	24,000	890	750	620	1,500	250	10,000	540	-	-	-
Other Parameters (ppm)																	
Total Organic Carbon	14	6	82	23	28	48	30	13	23	18	26	24	13	12	8	7	4
Total Organic Halogen	0.38	0.15	0.14	1.5	13	73	26	3.1	40	36	0.94	2.2	0.44	0.64	0.46	0.85	0.26
Alkalinity	460	-	-	-	380	-	-	-	570/550	510	-	-	-	-	-	-	270
Chloride	180	-	-	-	290	-	-	-	220/220	210	-	-	-	-	-	-	13
Sulfate	60	-	-	-	3	-	-	-	4	3	-	-	-	-	-	-	15
Field pH	6.0	6.6	6.7	6.6	6.5	6.6	6.5	6.8	6.6	6.8	6.7	6.6	6.6	6.5	6.5	6.4	6.3
Field Specific Conductance (umhos/cm @ 25°C)	470	310	590	440	1500	220	1600	480	510	500	500	505	330	340	220	220	150
Field Temperature(°C)	23	23	25	26	23	22	25	23	21	24	22	29	23	23	24	25	23

TABLE 7
PERMEABILITY TEST RESULTS

<u>WELL</u>	<u>PERMEABILITY</u> <u>(cm/sec)</u>	<u>SOIL TYPE</u>
MW-1	2.1×10^{-4}	Silty clay
MW-4	1.3×10^{-5}	Sand/silty clay
MW-6	1.2×10^{-4}	Fill
MW-7	7.7×10^{-4}	Sand/silty clay
MW-12	3.5×10^{-3}	Sand/silty clay

TABLE 8
STREAM SEDIMENT ANALYSES SUMMARY

PARAMETER	SAMPLE IDENTIFICATION	
<u>Volatile Priority Pollutants</u> (ppb)	NC-D	NC-U
	None Detected	
<u>Volatile Non Priority Pollutants</u> (ppb)		
	None Detected	
<u>Other Parameters</u> (ppm)		
Total Organic Carbon	3500	3300
Total Organic Halogen	0.40/0.46	0.74

TABLE 9
SELECTION OF INDICATOR CONTAMINANTS

	FREQUENCY OF POSITIVE DETECTIONS (NO. OF +/NO. OF SAMPLES)	OBSERVED RANGE ($\mu\text{g/l}$)	REMARKS
Benzene	15/16	22-85,000	
Chlorobenzene	15/16	13-230,000	
Chlorodibromomethane	1/16	2.7	
Chloroethane	11/16	4.1-1,600	4.1-67 (without maximum outlier)
Chloroform	1/16	12	
1,1-Dichloroethane	11/16	1.1-120	1.1-46 (without maximum)
1,2-Dichloroethane	4/16	1.1-9.9	
1,1-DCEthene	3/16	1.4-8.6	
1,3-DCEthene	5/16	6.0-79	
Ethylbenzene	9/16	44-2,700	
Methylene chloride	3/16	14-630	14-21 (without maximum)
1,1,2,2-Tetrachloroethane	3/16	1.9-15	
Tetrachloroethylene	6/16	1.0-1,000	
Toluene	14/16	1.0-5,200	
1,2,-trans-DCEthene	11/16	1.3-640	
1,1,1-Trichloroethane	9/16	4.1-330	
Trichloroethylene	1/16	11	
Vinyl Chloride	5/16	10-60	
Acetone	6/16	12-65	
2-Butanone	5/16	62-100	
Carbon disulfide	7/16	13-48	
4-methyl-2-pentanone	1/16	26	
Styrene	7/16	7.6-250	
Xylenes	11/16	250-24,000	

APPENDIX A
TEST PITS AND BOREHOLE LOGS

GENERAL NOTES AND LEGEND

Symbols to be used for designation of subsurface materials on all boring logs and subsurface sections



GRAVEL



SAND



SILT



CLAY



ORGANIC MATTER



ROOTS



FILL



WATER



APPROXIMATE EXISTING
GROUND



APPROXIMATE TOP
OF ROCK



SLAG



PEAT



2" O.D. SPLIT BARREL SAMPLE

75/0.5

PENETRATION REFUSAL RESISTANCE AND
FRACTIONAL INCREMENT DRIVEN IN FEET



GROUND WATER LEVEL AND DATE

USCS

UNIFIED SOIL CLASSIFICATION SYSTEM (CAPITAL LETTERS
INDICATE LAB TEST CLASSIFICATION, LOWER CASE LETTERS
INDICATE VISUAL FIELD CLASSIFICATION)

TRACE - INDICATES PRESENCE OF 5 TO 12% OF SUBJECT MATERIAL BY WEIGHT.
SOME - INDICATES PRESENCE OF 12 TO 30% OF SUBJECT MATERIAL BY WEIGHT.
AND - INDICATES APPROXIMATELY EQUAL PORTIONS OF SUBJECT MATERIAL BY WEIGHT.

STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2 INCH O. D. SPLIT BARREL SAMPLER 12 INCHES USING A 140 POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER WAS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6 INCH INTERVAL. THE RESISTANCE TO PENETRATION IS INDICATED ON THE DRAWING AS BLOWS PER FOOT.

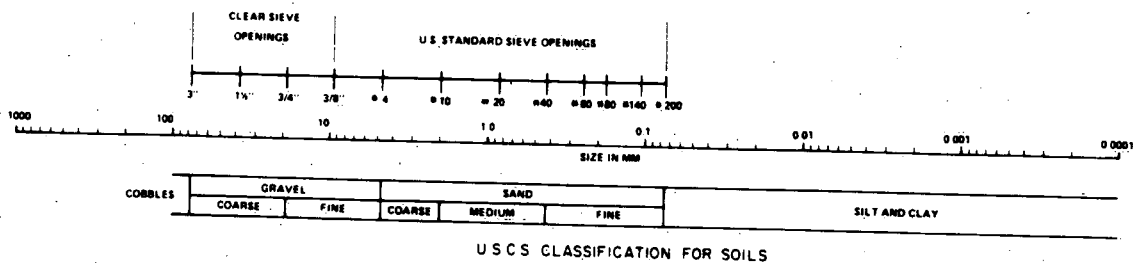
THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING LOCATIONS. ALSO THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE BORING LOCATIONS.

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH TONS PER SQUARE FOOT
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DESIGNATION	BLOWS PER FOOT
VERY LOOSE	0-4
LOOSE	5-10
MEDIUM DENSE	11-30
DENSE	31-50
VERY DENSE	OVER 50



DATE BEGAN: 8-3-85

DATE FINISHED: 8-30-85

GROUND SURFACE EL.: 9.0'

BORING NO. B-1

FIELD ENGINEER: DAN HOLZMAN

CHECKED BY: GARY GAILLOT

N _____ E _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
		S		ASPHALT 0.1'					
	2.5	1 S		FILL: (LOOSE TO MEDIUM DENSE, BROWN CLAYEY FINE TO MEDIUM SAND, SOME FINE TO COARSE CRUSHED GRAVEL, MOIST) 1.8'					
		2 S		MEDIUM STIFF, RED-BROWN SILTY CLAY, TRACE FINE GRAVEL, MOIST					
	5.0	3 S		VERY STIFF, RED-BROWN SILTY CLAY, TRACE FINE GRAVEL, MOIST	cl				
		4 S		HARD, RED-BROWN SILTY CLAY, TRACE FINE SAND AND GRAVEL, MOIST					
1.0	7.5 8.0							69	
				BOTTOM OF BORING 8.0'					

PROJECT NO. 671030

BORING NO. B-1
SHEET 1 OF 1

DATE BEGAN: 8-30-85

BORING NO. MW-1

FIELD ENGINEER: DAN HOLZMAN

DATE FINISHED: 8-30-85

CHECKED BY: GARY GAILLOT

GROUND SURFACE EL.: 8.98'

N E

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
				CRUSHED SLAG 0.2'					NO SAMPLES COLLECTED SAME AS MW-2
	2.5			FILL: (MEDIUM DENSE, BROWN FINE TO COARSE SAND AND CRUSHED SLAG, DRY) 2.0'					
	5.0			MEDIUM DENSE, BROWN FINE TO MEDIUM SAND, TRACE CRUSHED GRAVEL, MOIST 4.0'	sp				
				MEDIUM STIFF, RED-BROWN SILTY CLAY, TRACE FINE SAND, MOIST 6.0'	cl				
8-30-85	7.5			VERY STIFF TO MEDIUM STIFF, RED- BROWN SILTY CLAY, TRACE FINE SAND AND GRAVEL, MOIST	cl				
0.0									
-1.02	10.0								
				BOTTOM OF BORING 10.0'					

PROJECT NO. 671030

BORING NO. MW-1

SHEET 1 OF 1

DATE BEGAN: 8-28-85
 DATE FINISHED: 8-28-85
 GROUND SURFACE EL.: 8.47'

BORING NO. MW-2
 N _____ E _____

FIELD ENGINEER: DAN HOLZMAN
 CHECKED BY: GARY GAILLOT

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENTRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	REMARKS
		S		CRUSHED SLAG 0.2'			
		1		FILL: (MEDIUM DENSE, BROWN FINE TO COARSE SAND AND CRUSHED SLAG, DRY) 2.0'			
	2.5	S			sp		
		2		MEDIUM DENSE, BROWN FINE TO MEDIUM SAND, TRACE CRUSHED GRAVEL, MOIST 4.0'			
	5.0	S			cl		
		3		MEDIUM STIFF, RED-BROWN SILTY CLAY, TRACE FINE SAND, MOIST 6.0'			
		S					
8-28-85	7.5	4		MEDIUM STIFF TO VERY STIFF, RED-BROWN SILTY CLAY, TRACE FINE SAND AND GRAVEL, MOIST			
0.0		S					
	10.0	5			cl		
		S					
	12.5	6					
		S					
	12.5	7		MEDIUM DENSE, RED-BROWN FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL AND SILTY CLAY, WET 14.0'	sp		
	15.0	S					
		8		MEDIUM DENSE TO VERY DENSE RED-BROWN FINE TO COARSE SAND, TRACE FINE GRAVEL, WET			
		S					
	17.5	9			sw		
-10.0		S					
	20.0	10					
		S					
	22.5	11		DENSE TO VERY DENSE, RED-BROWN FINE TO COARSE SAND, TRACE SILTY CLAY AND COARSE TO FINE GRAVEL, WET TO MOIST	sw		
		S					
	25.0	12					
		S		DENSE, RED-BROWN FINE TO COARSE SAND, TRACE FINE GRAVEL, WET			

PROJECT NO. 671030

BORING NO. MW-2
 SHEET 1 OF 2


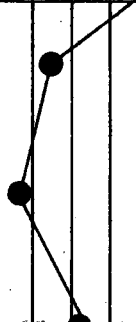
GROUND SURFACE EL.: 8.47'

BORING NO. MW-2

FIELD ENGINEER: DAN HOLZMAN

CHECKED BY: GARY GAILLOT

N E

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
		13		DENSE TO VERY DENSE, RED-BROWN FINE TO COARSE SAND, TRACE FINE GRAVEL, WET TO MOIST	SW				
		S							
-20.0	27.5	14							
		S							
-21.53	30.0	15							
BOTTOM OF BORING 30.0'									

PROJECT NO. 671030

BORING NO. MW-2
SHEET 1 OF 2

DATE BEGAN: 8-28-85
 DATE FINISHED: 8-28-85
 GROUND SURFACE EL.: 9.31'

BORING NO. MW-3

FIELD ENGINEER: DAN HOLZMAN
 CHECKED BY: GARY GAILLOT





















N _____ E _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
		S		ASPHALT 0.1'					AUGERED TO 2' DUE TO GRAVEL ECT., S-1 COLLECTED FROM AUGER CUTTINGS
	2.5	1		FILL: (LOOSE, DARK BROWN TO BLACK FINE TO MEDIUM SAND AND CRUSHED FINE TO COARSE GRAVEL, TRACE BRICK FRAGMENTS, DRY)					
		S		FILL: (LOOSE, DARK BROWN FINE TO COARSE SAND, SOME CRUSHED GRAVEL, WET) 3.5'					
	5.0	2		LOOSE, DARK BROWN FINE TO MEDIUM SAND, TRACE SILTY CLAY, WET	sw				
		S		5.5'					
	7.5	3		SOFT, RED-BROWN SILTY CLAY, TRACE FINE SAND, MOIST					
		S		7.0'					
0.0		4							
		S							
	10.0	5		MEDIUM STIFF, RED-BROWN SILTY CLAY, TRACE FINE SAND AND FINE TO COARSE GRAVEL, MOIST	cl				
		S							
	12.5	6							
		S							
	14.0	7		VERY STIFF RED-BROWN SILTY CLAY, MOIST 12.5'					
-4.69									
				BOTTOM OF BORING 14.0'					

PROJECT NO. 671030

BORING NO. MW-3
 SHEET 1 OF 1

FIELD ENGINEER: DAN HOLZMAN
CHECKED BY: GARY GAILLOT

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENTRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
		S		ASPHALT .01'					
		1		FILL: (LOOSE, BROWN FINE TO COARSE SAND AND CRUSHED GRAVEL) 2.0'					
	2.5	S		MEDIUM DENSE, BROWN FINE TO MEDIUM SAND, TRACE GRAVEL, MOIST	sp				
		2							
		S							
	5.0			MEDIUM STIFF, RED-BROWN SILTY CLAY, TRACE FINE SAND AND FINE TO COARSE GRAVEL, MOIST 5.0'					
		3							
		S							
	7.5								
		4							
		S							
0.0									
	10.0				cl				
		5							
		S							
	12.5								
		6							
		S							
-5.32	14.0								
		7							
				BOTTOM OF BORING 14.0'					

FIELD ENGINEER: DAN HOLZMAN
CHECKED BY: GARY GAILLOT

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENTRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
				ASPHALT 0.1'					
				FILL: (CRUSHED SLAG AND SAND) 0.6'					
	2.5	S		FILL: (MEDIUM DENSE, BLACK FINE TO MEDIUM SAND, SOME CRUSHED GRAVEL, MOIST)					59/0.2'
		S		FILL: (LOOSE, BROWN FINE TO MEDIUM SAND, SOME CRUSHED GRAVEL, MOIST)					
	5.0	S		FILL: (VERY LOOSE, BROWN TO BLACK FINE TO MEDIUM SAND, TRACE CRUSHED GRAVEL, MOIST TO WET)					
		S							
	7.5	S		SOFT, PEAT, SOME CLAY, MOIST	pt				
		S							
0.0		S		SOFT, PEAT, SOME CLAY AND FINE SAND, MOIST	pt				
-0.84	10.0	S		LOOSE, BROWN FINE TO MEDIUM SAND, WET	sp				
				BOTTOM OF BORING 10.0'					

DATE BEGAN: 8-27-85
 DATE FINISHED: 8-27-85
 GROUND SURFACE EL.: 8.84'

BORING NO. MW-6

FIELD ENGINEER: DAN HOLZMAN
 CHECKED BY: GARY GAILLOT

N _____ E _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
				ASPHALT 0.1'					
		S 1		FILL: (MEDIUM DENSE, DARK BROWN MEDIUM SAND, SOME GRAVEL, MOIST)					
	2.5	S 2		FILL: (DENSE, BROWN MEDIUM SAND, SOME GRAVEL AND TAR IMPREGNATED SAND, TRACE BROKEN GLASS, MOIST)					
	5.0	S 3		FILL: (MEDIUM DENSE, BROWN TO BLACK MEDIUM TO COARSE SAND, TRACE FIBERBOARD AND GRAVEL, MOIST)					
	7.5	S 4							
0.0		S 5		FILL: (LOOSE, DARK BROWN TO BLACK FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL, WET (CINDERS))					
	10.0	S 6		FILL: (LOOSE, DARK BROWN TO BLACK FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL AND CINDERS, WET)					
	12.5	S 7		FILL: (MEDIUM DENSE, BLACK FINE TO COARSE SAND, SOME FINE TO COARSE GRAVEL, WET)					
	15.0	S 8		FILL: (LOOSE, BLACK FINE TO COARSE SAND, TRACE CRUSHED GRAVEL AND BRICK FRAGMENTS, WET) 15.0'					
		S 9		SOFT, PEAT, SOME CLAY, MOIST					
-10.0	17.5	S 10			pt				
-11.16	20.0								
				BOTTOM OF BORING 20.0'					

PROJECT NO. 671030

BORING NO. MW-6
 SHEET 1 OF 1

DATE BEGAN: 8-30-85
 DATE FINISHED: 8-30-85
 GROUND SURFACE EL.: 8.83'

BORING NO. MW-7

FIELD ENGINEER: DAN HOLZMAN
 CHECKED BY: GARY GAILLOT

N _____ E _____


ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
				ASPHALT 0.1'					AUGERED FROM 0.0' TO 18.0'. DESCRIPTIONS FROM MW-6
				FILL: (MEDIUM DENSE, DARK BROWN MEDIUM SAND, SOME GRAVEL, MOIST)					
	2.5			FILL: (DENSE, BROWN MEDIUM SAND, SOME GRAVEL AND TAR IMPREGNATED SAND, TRACE BROKEN GLASS, MOIST)					
	5.0			FILL: (MEDIUM DENSE, BROWN TO BLACK MEDIUM TO COARSE SAND, TRACE FIBERBOARD AND GRAVEL, MOIST)					
	7.5								
0.0				FILL: (LOOSE, DARK BROWN TO BLACK FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL, WET (CINDERS))					
	10.0			FILL: (LOOSE, DARK BROWN TO BLACK FINE TO COARSE GRAVEL AND CINDERS, WET)					
	12.5			FILL: (MEDIUM DENSE, BLACK FINE TO COARSE SAND, SOME FINE TO COARSE GRAVEL, WET)					
	15.0			FILL: (LOOSE, BLACK FINE TO COARSE SAND, TRACE CRUSHED GRAVEL AND BRICK FRAGMENTS, WET) 15.0'					
	17.5			SOFT, PEAT, SOME CLAY, MOIST	pt				
-10.0	20.0	S		SOFT, PEAT, SOME CLAY 18.0'					
	22.5	S			pt				
		1							
		2							
		3							
	23.5	S		LOOSE, GRAY FINE TO MEDIUM SAND, WET 22.5'	sp				
	23.8	S		SOFT, GRAY SILTY CLAY, SOME SAND 23.5'	cl				
25.0				AS BELOW	ml/cl				

PROJECT NO. 671030

BORING NO. MW-7
 SHEET 1 OF 2

FIELD ENGINEER: DAN HOLZMAN
CHECKED BY: GARY GAILLOT

N_____E_____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENTRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
-20.0		4		SOFT, GRAY SILTY CLAY, SOME FINE TO MEDIUM SAND, TRACE FINE TO COARSE GRAVEL, MOIST 25.5'	ml/cl				
		S			cl				
	27.5	5		MEDIUM DENSE, RED-BROWN SILTY CLAY, SOME FINE TO MEDIUM SAND AND SHALE FRAGMENTS, MOIST 27.0'					
		S			sw				
	30.0	6		MEDIUM DENSE, RED-BROWN FINE TO COARSE SAND, TRACE COARSE GRAVEL, AND SILT 29.0'					
		S		MEDIUM DENSE, RED-BROWN FINE TO COARSE SAND, SOME GRAVEL, WET 30.0'	sp				
	32.5	7		MEDIUM DENSE, BROWN FINE TO COARSE SAND, TRACE FINE GRAVEL, WET 32.5'	sw				
		S			cl				
		8		MEDIUM STIFF, TAN FINE SANDY SILTY CLAY, MOIST 33.0'					
-27.17		S		MEDIUM DENSE, TAN FINE SAND, TRACE SILT, WET 35.0'	sp				
	35.0								
	36.0	9	MEDIUM DENSE, BROWN TO TAN FINE TO COARSE SAND, WET 36.0'	sw					
				BOTTOM OF BORING 36.0'					

DATE BEGAN: 8-29-85
 DATE FINISHED: 8-29-85
 GROUND SURFACE EL.: 9.43'

BORING NO. MW-8

FIELD ENGINEER: DAN HOLZMAN

CHECKED BY: GARY GAILLOT

N _____ E _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
		S		FILL: (LOOSE, BROWN FINE TO MEDIUM SAND, SOME RED BROWN CLAY, TRACE CRUSHED GRAVEL, DRY)					
	2.5	S		FILL: (MEDIUM DENSE, DARK BROWN TO BLACK FINE TO MEDIUM SAND, TRACE CRUSHED GRAVEL, MOIST)					
		2		FILL: (MEDIUM STIFF, RED-BROWN SILTY CLAY AND BROWN TO BLACK FINE TO MEDIUM SAND, TRACE CRUSHED GRAVEL, MOIST)					
	5.0	S							
		3							
		S		FILL: (LOOSE, DARK BROWN TO BLACK FINE TO COARSE SAND, TRACE CRUSHED GRAVEL, WET)					
	7.5	4							
		S		FILL: (LOOSE, DARK BROWN TO BLACK FINE TO COARSE SAND, TRACE RED BROWN SILTY CLAY, WET)					
0.0	10.0	5							
		S		FILL: (LOOSE, DARK BROWN TO BLACK FINE TO COARSE SAND, TRACE FINE CRUSHED GRAVEL, WET)					
	12.5	6							
		S							
	13.0'	7		SOFT, PEAT, SOME BROWN SILTY CLAY, MOIST					
	15.0	S							
		8		SOFT, PEAT, SOME SILTY CLAY, MOIST					
	17.5	S			pt				
		9							
-10.0		S							
-10.57	20.0	10							
				BOTTOM OF BORING 20.0'					

DATE BEGAN: 8-29-85
 DATE FINISHED: 8-29-85
 GROUND SURFACE EL.: 10.40'

BORING NO. MW-9

FIELD ENGINEER: DAN HOLZMAN
 CHECKED BY: GARY GAILLOT

N _____ E _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
10.0		S		ASPHALT 0.15'					
				CRUSHED GRAVEL 0.50'					
				CONCRETE 1.5'					
	2.5	S		FILL: (LOOSE, BROWN TO BLACK FINE TO COARSE SAND, SOME CRUSHED GRAVEL, MOIST)					
8-29-85		2							
	5.0	S		FILL: (LOOSE, BROWN TO BLACK TO RED-BROWN FINE TO MEDIUM SAND, SOME FINE CRUSHED GRAVEL, WET)					
		3							
	7.5	S							
		4		SOFT, SILT, SOME CLAY, TRACE ROOT FIBER, WET 7.2'					
		S			ol				
				PEAT, TRACE SILTY CLAY, MOIST 8.5'					
		5			pt				
0.0	10.0	S		LOOSE, BROWN FINE TO MEDIUM SAND, TRACE SILT, CLAY, WET 9.5'					
		6							
	12.5	S			sp				
		7							
	15.0	S		MEDIUM STIFF, RED-BROWN SILTY CLAY, TRACE FINE TO COARSE SAND AND FINE GRAVEL, MOIST 13.5'					
		8			cl				
	16.0			MEDIUM STIFF, RED-BROWN SILTY CLAY, TRACE COARSE GRAVEL, MOIST					
				BOTTOM OF BORING 26.0'					

DATE BEGAN: 8-29-85
 DATE FINISHED: 8-29-85
 GROUND SURFACE EL.: 10.83'

BORING NO. MW-10

FIELD ENGINEER: DAN HOLZMAN
 CHECKED BY: GARY GAILLOT

N _____ E _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
10.0		S		CRUSHED SLAG 0.2'					AUGERED TO 10.0' SAMPLED TO 14.0' WITH SPLIT SPOON
		1		FILL: (LOOSE, DARK BROWN FINE TO COARSE SAND, SOME FINE CRUSHED GRAVEL, DRY)					
	2.5	S		FILL: (LOOSE, DARK BROWN TO BLACK FINE TO COARSE SAND, SOME FINE TO COARSE CRUSHED GRAVEL, WET)					
		2							
		S							
	2.5	S		LOOSE, BROWN FINE TO MEDIUM SAND, WET					
		3							
		S		LOOSE, DARK BROWN TO BLACK FINE TO MEDIUM SAND, SOME FINE CRUSHED GRAVEL, WET	sp				
		4							
	7.5	S		SOFT, RED-BROWN SILTY CLAY, TRACE FINE TO MEDIUM SAND, MOIST	cl				
		5							
	10.0	S		MEDIUM STIFF, RED BROWN-SILTY CLAY, TRACE COARSE GRAVEL, MOIST	cl				
		6							
	12.5	S			cl				
-3.17	14.0	7							
				BOTTOM OF BORING 14.0'					

PROJECT NO. 671030

BORING NO. MW-10
 SHEET 1 OF 1

DATE BEGAN: 8-29-85
 DATE FINISHED: 8-29-85
 GROUND SURFACE EL.: 11.25'

BORING NO. MW-11

FIELD ENGINEER: DAN HOLZMAN
 CHECKED BY: GARY GAILLOT

N _____ E _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
10.0		S		CRUSHED GRAVEL 0.2'					AUGERED TO 10.0' SAMPLED TO 14.0' WITH SPLIT SPOON
		1		FILL: (LOOSE, BLACK FINE TO COARSE SAND, SOME FINE TO COARSE GRAVEL AND CINDERS, MOIST)					
	2.5	S							
		2							
	5.0	S							
		3		LOOSE, BROWN FINE TO MEDIUM SAND, WET 5.0'					
		S			sp				
	7.5	4		SOFT, RED-BROWN SILTY CLAY, TRACE FINE GRAVEL AND FINE SAND, MOIST 7.0'					
		S							
	10.0	5							
0.0		S		MEDIUM STIFF, RED-BROWN SILTY CLAY, TRACE FINE GRAVEL AND FINE SAND, MOIST 10.0'	cl				
	12.5	S							
-2.75	14.0	7							
				BOTTOM OF BORING 14.0'					

PROJECT NO. 671030


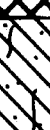
BORING NO. MW-11
 SHEET 1 OF 1

DATE BEGAN: 8-30-85
 DATE FINISHED: 8-30-85
 GROUND SURFACE EL.: 12.48'

BORING NO. MW-12

FIELD ENGINEER: DAN HOLZMAN
 CHECKED BY: GARY GAILLOT

N _____ E _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT)			REMARKS
						10	30	50	
10.0	2.5	S		FILL: (LOOSE, BLACK FINE TO COARSE SAND AND GRAVEL, TRACE CINDERS, MOIST)					
		1							
2.40	10.0	S		FILL: (LOOSE, BLACK FINE TO MEDIUM SAND, TRACE COARSE GRAVEL AND FINE CINDERS, WET)					
		2							
		S		LOOSE, BROWN SILTY CLAY AND FINE SAND, WET					
		3							
		S							
2.40	10.0	4		MEDIUM STIFF TO DENSE, RED-BROWN SILTY CLAY, TRACE COARSE SAND, MOIST					
		S							
		5							
				BOTTOM OF BORING 10.0'					

sp/cl

cl

PROJECT NO. 671030

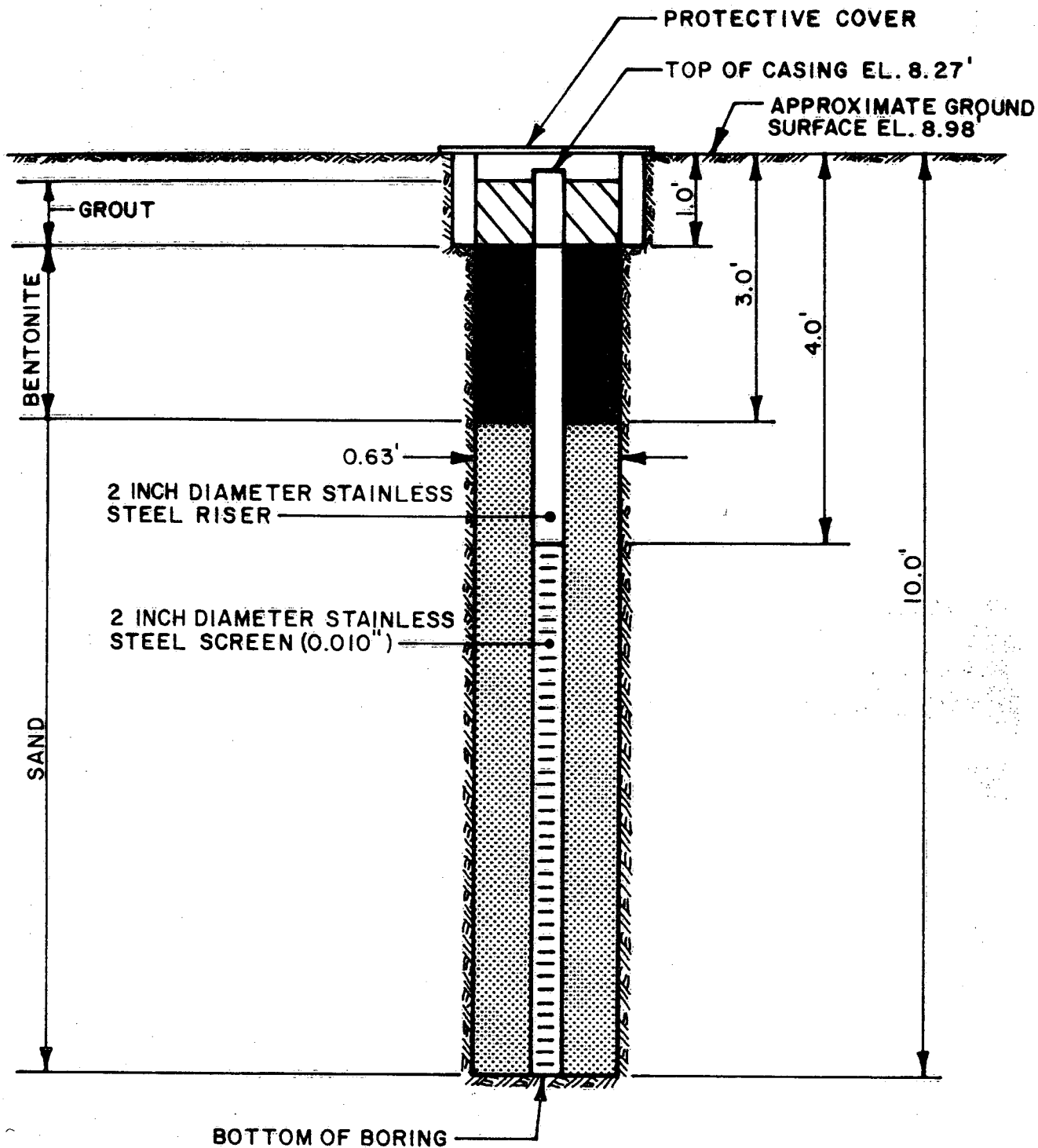
BORING NO. MW-12
 SHEET 1 OF 1

APPENDIX B
WELL COMPLETION DIAGRAMS

DRAWING NUMBER 671030-A3

CHECKED BY
10-23-85 APPROVED BY

DRAWN BY



"NOT TO SCALE"

FIGURE

MONITORING WELL MW-1

PREPARED FOR

UNION CHEMICALS
CARTERET, NEW JERSEY

85380

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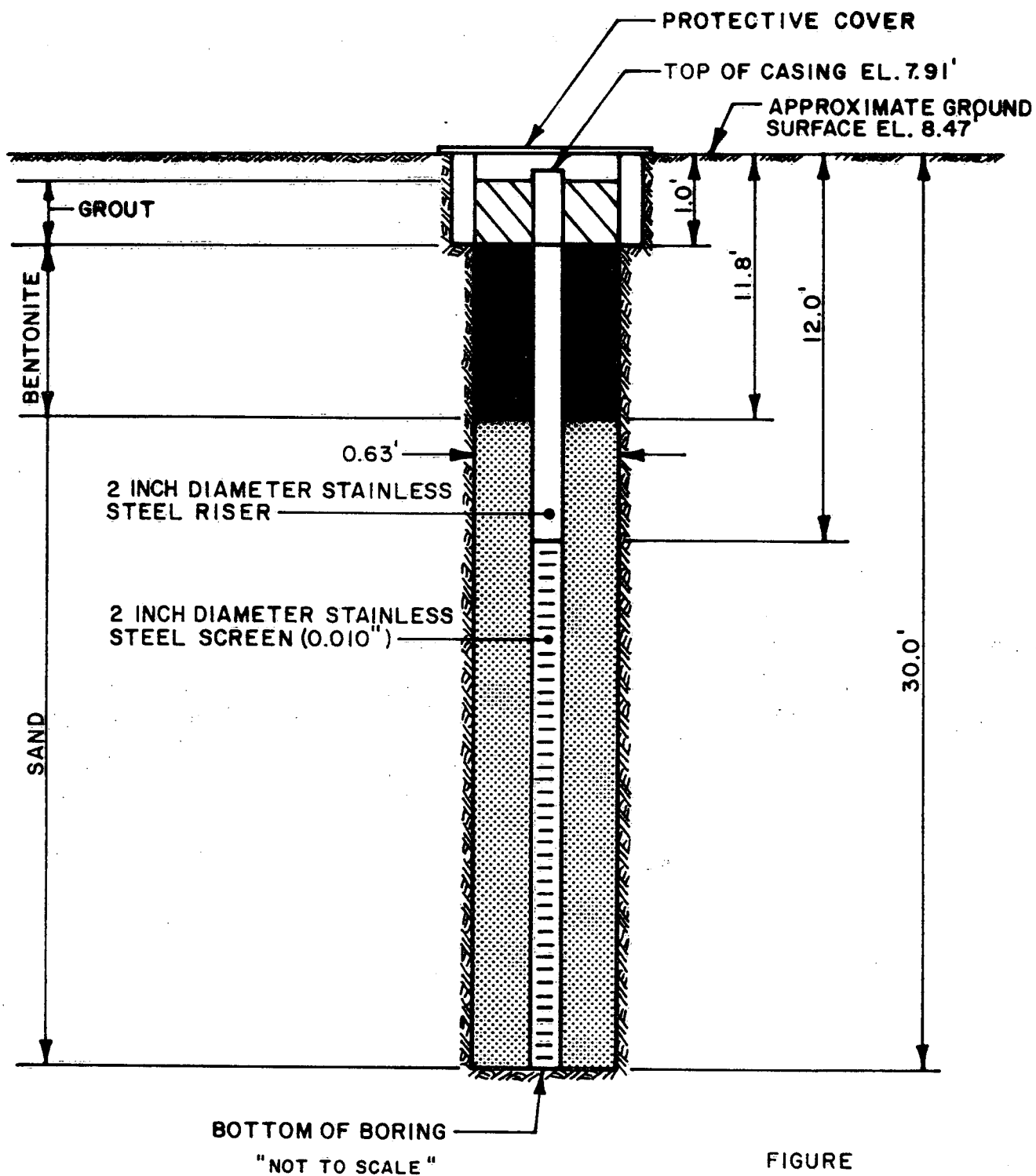
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... Creating a Safer Tomorrow

DRAWING 671030-A4
NUMBER

DRAWN BY
m81
10-23-85
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FIGURE

MONITORING WELL MW-2

PREPARED FOR

UNION CHEMICALS
CARTERET, NEW JERSEY

65360

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Do Not Scale This Drawing

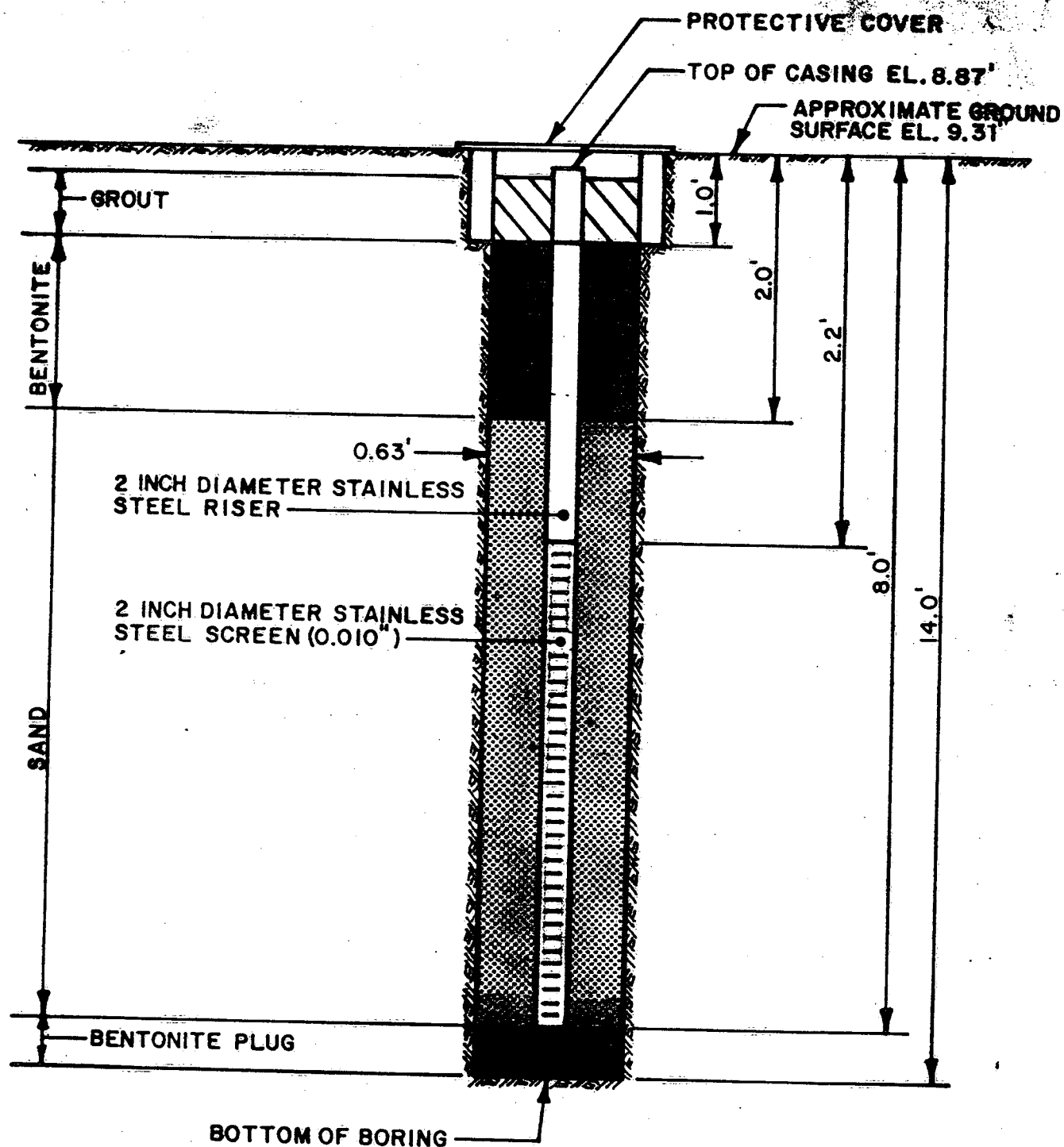


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NUMBER

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BOTTOM OF BORING
"NOT TO SCALE"

FIGURE

MONITORING WELL MW-3

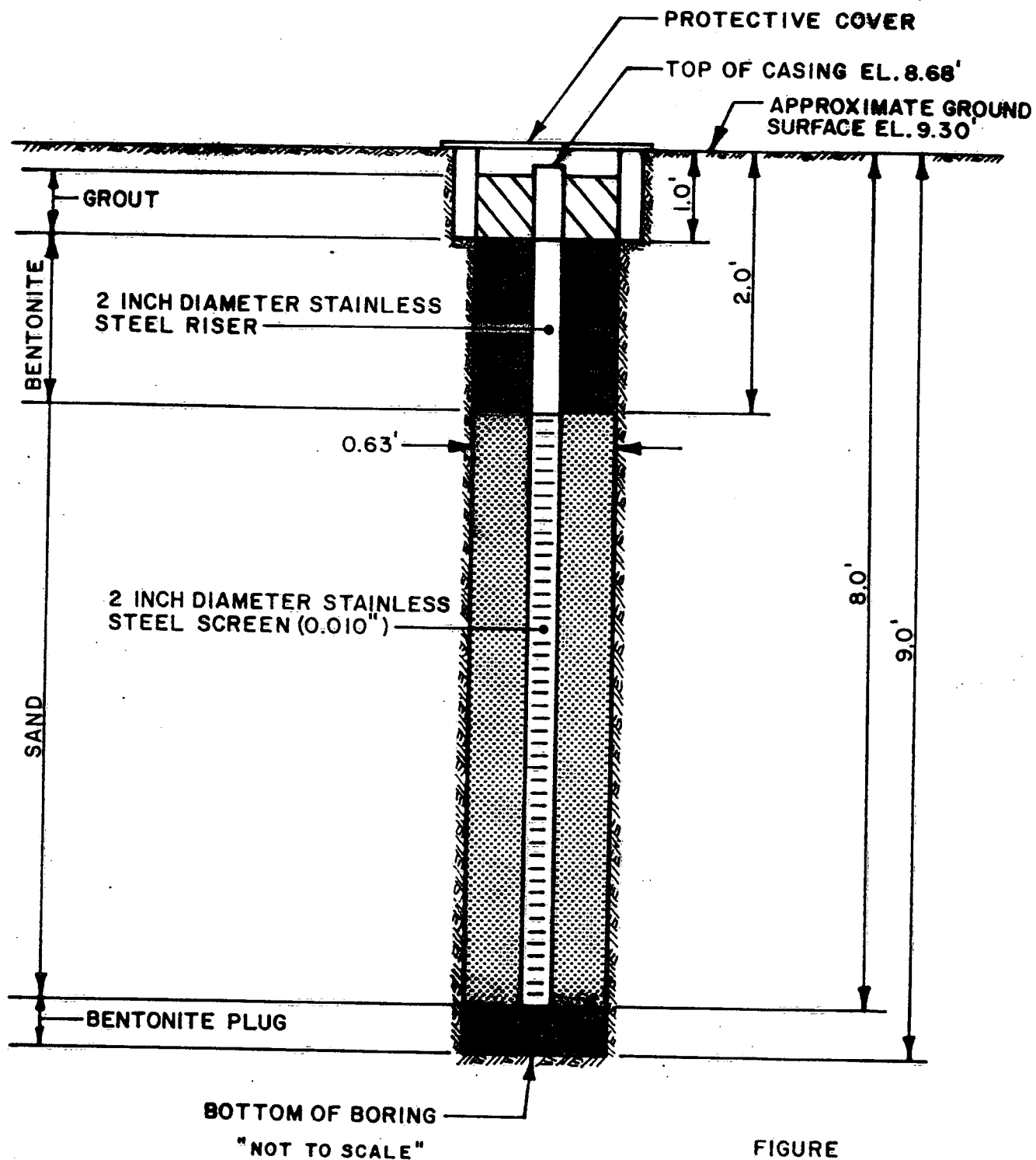
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DRAWING NUMBER 671030-A6

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10-23-85



BOTTOM OF BORING
"NOT TO SCALE"

FIGURE

MONITORING WELL MW-4

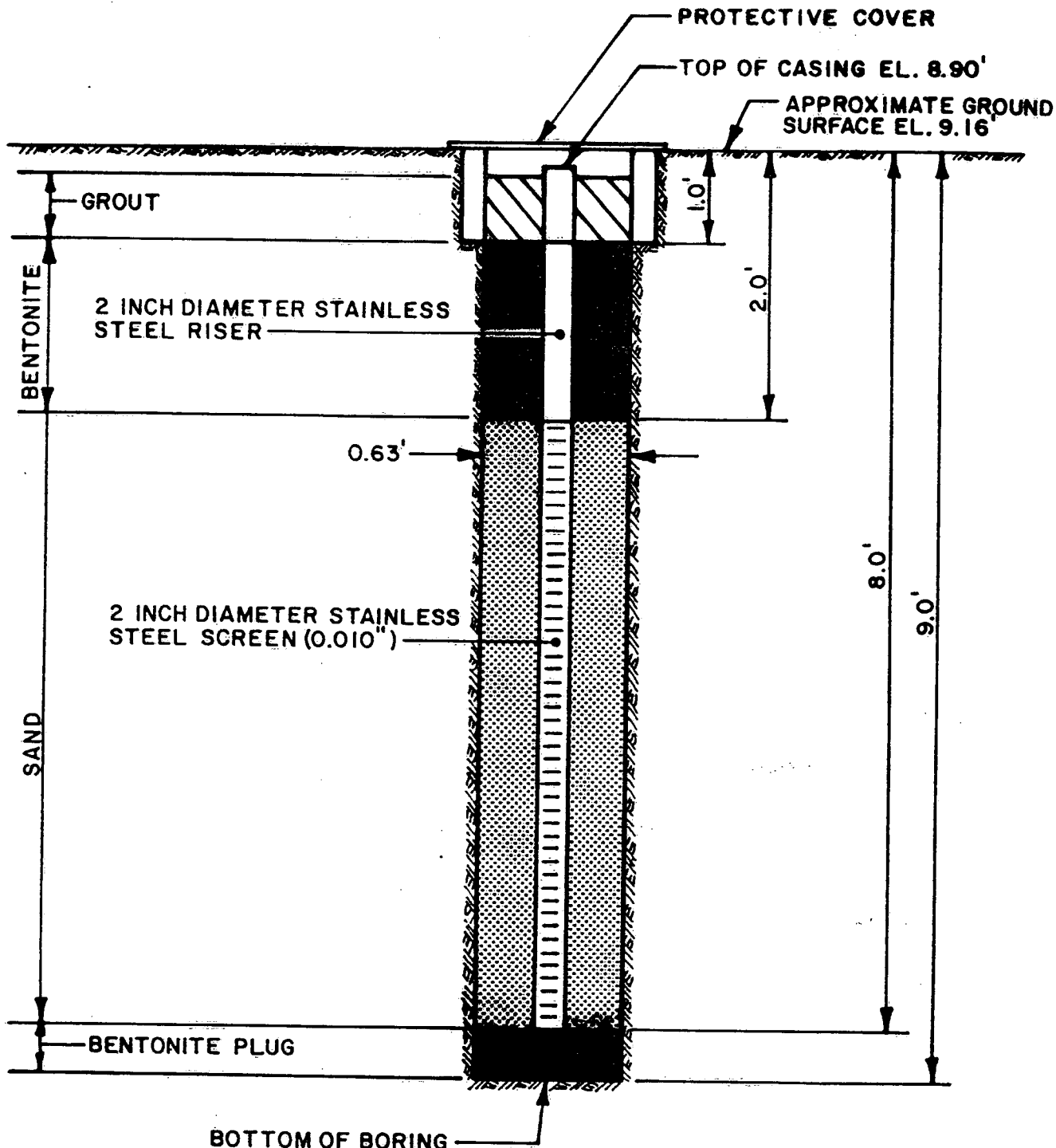
PREPARED FOR

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CARTERET, NEW JERSEY



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10-23-85



FIGURE

MONITORING WELL MW-5

PREPARED FOR

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CARTERET, NEW JERSEY

DRAWING NUMBER 671030-A8

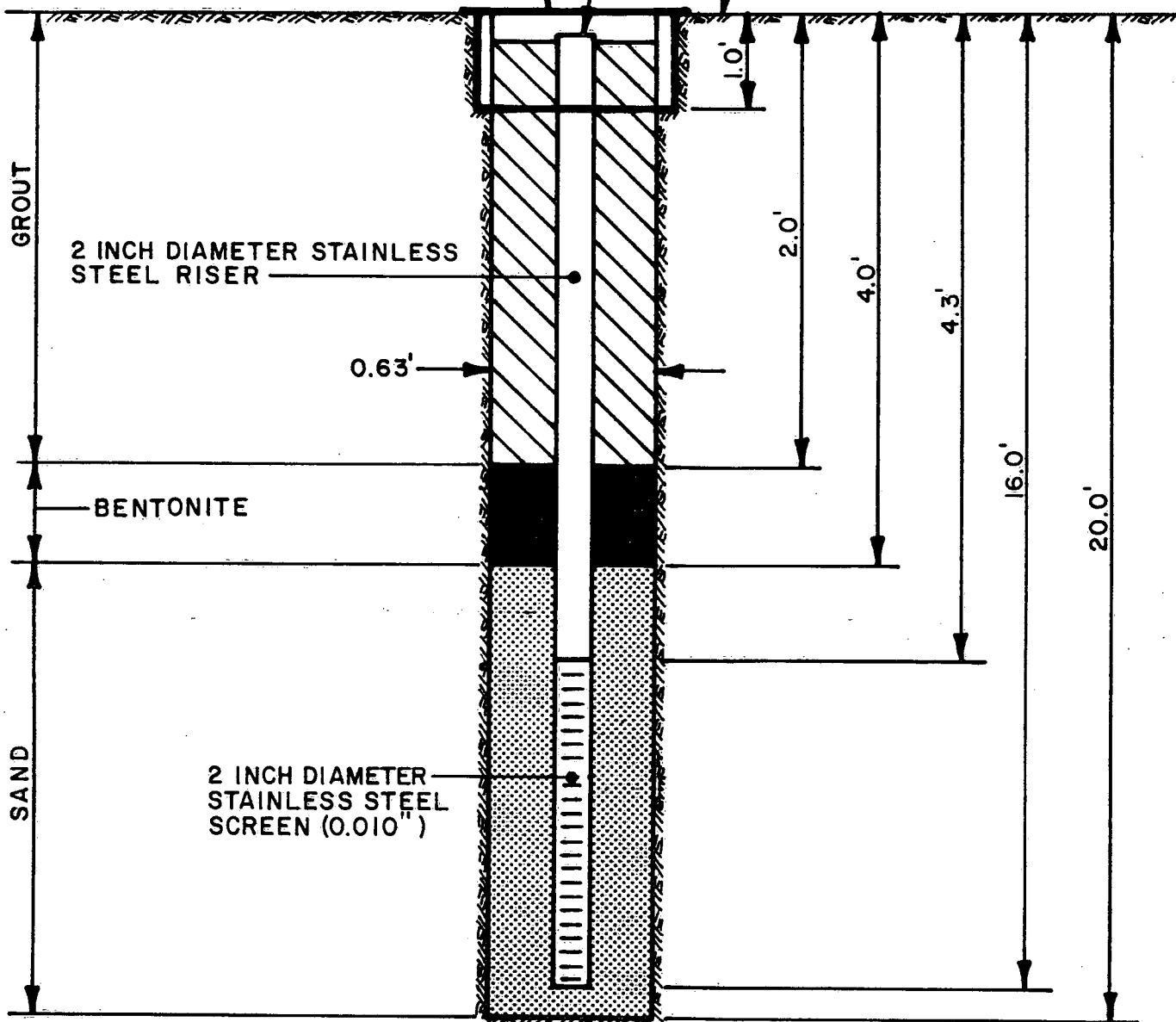
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10-23-83

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FLUSH MOUNT PROTECTIVE CASING

TOP OF CASING ELEVATION 8.60'

APPROXIMATE EXISTING
GROUND SURFACE EL. 8.84'



BOTTOM OF BORING
"NOT TO SCALE"

FIGURE

MONITORING WELL MW-6

PREPARED FOR

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CARTERET, NEW JERSEY

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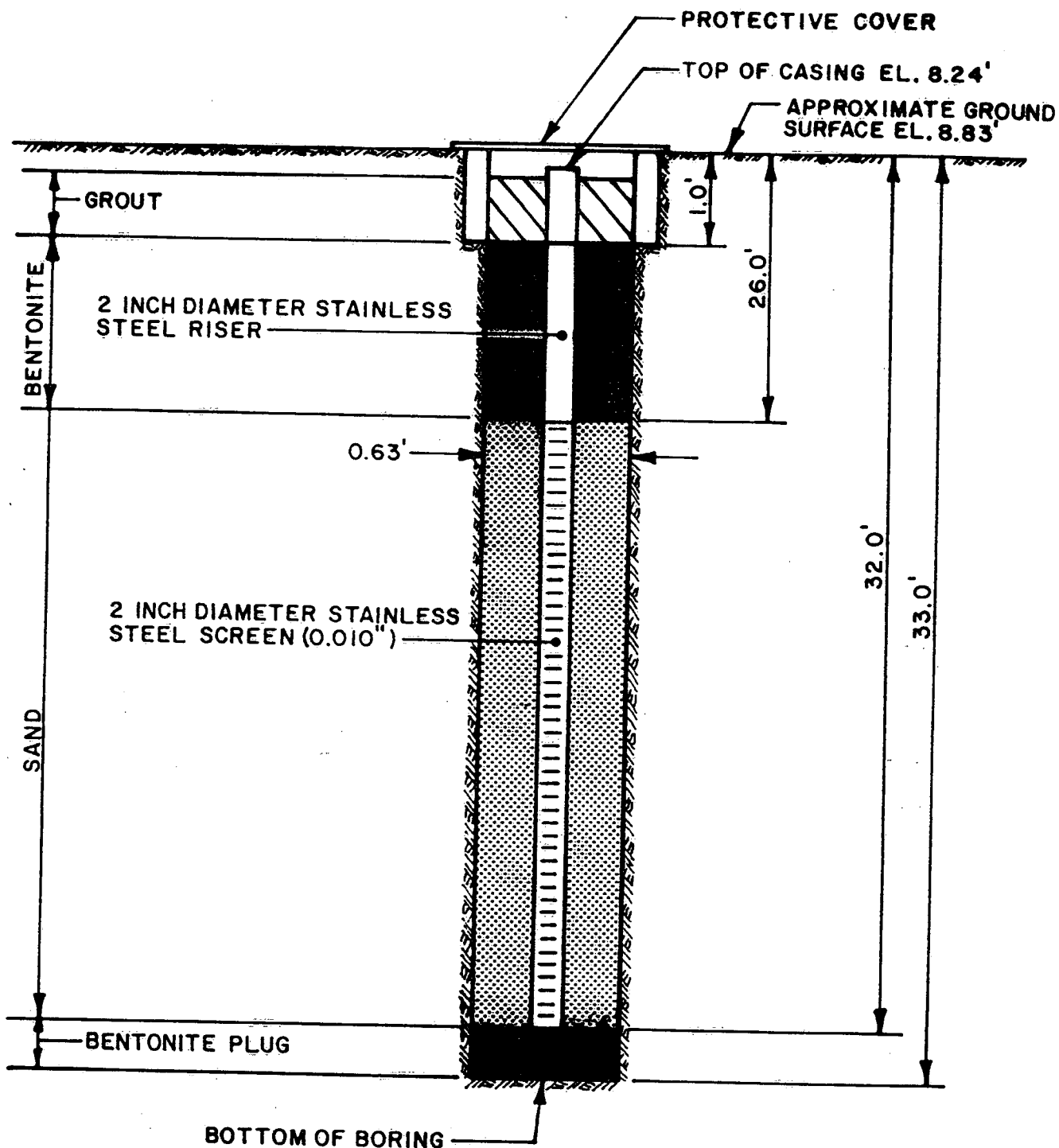
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FIGURE

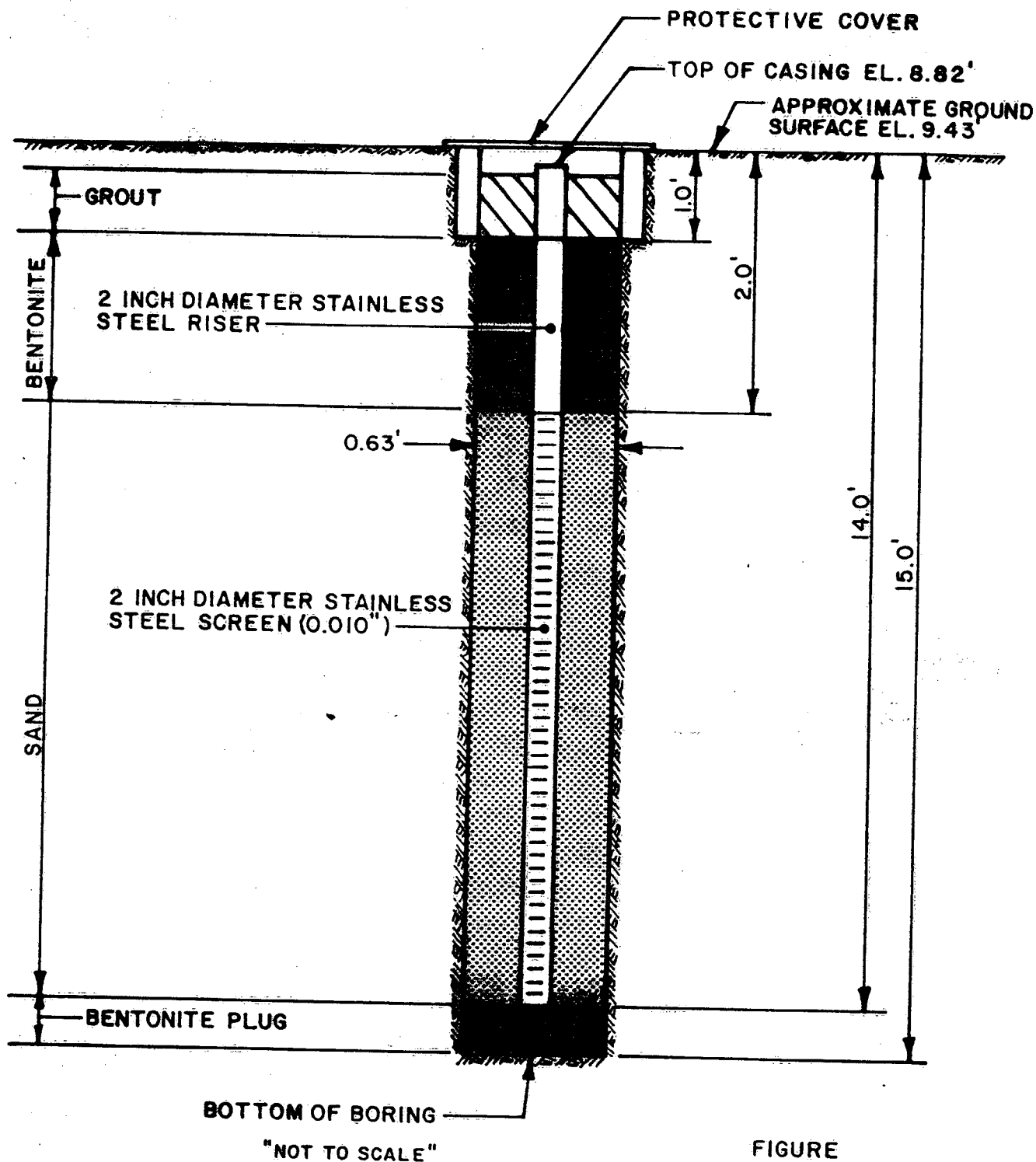
MONITORING WELL MW-7

PREPARED FOR

UNION CHEMICALS
CARTERET, NEW JERSEY

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NUMBER

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m6
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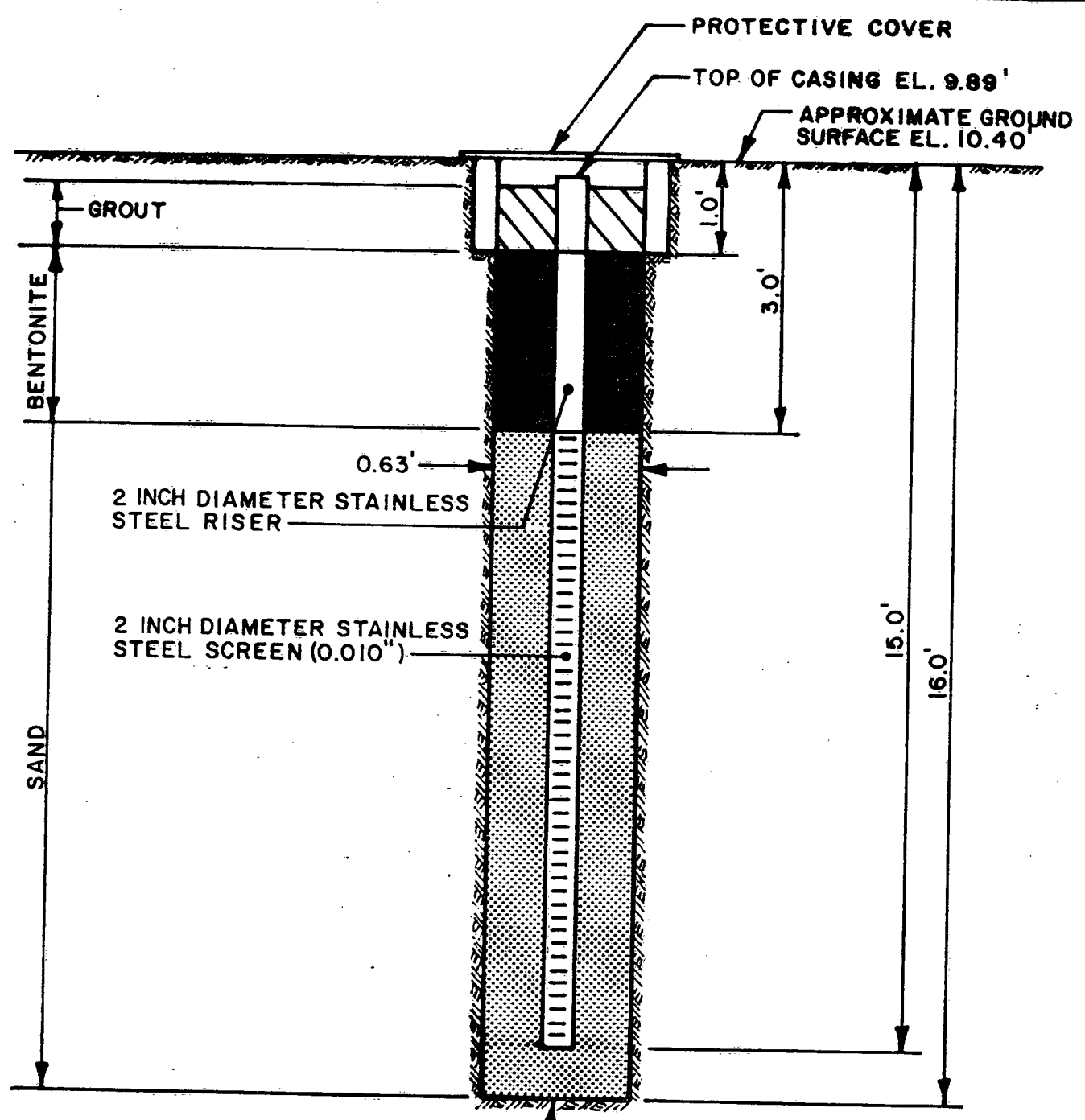
FIGURE

MONITORING WELL MW-8

PREPARED FOR

UNION CHEMICALS
CARTERET, NEW JERSEY

DRAWING 671030-A11
 NUMBER
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 10-23-85
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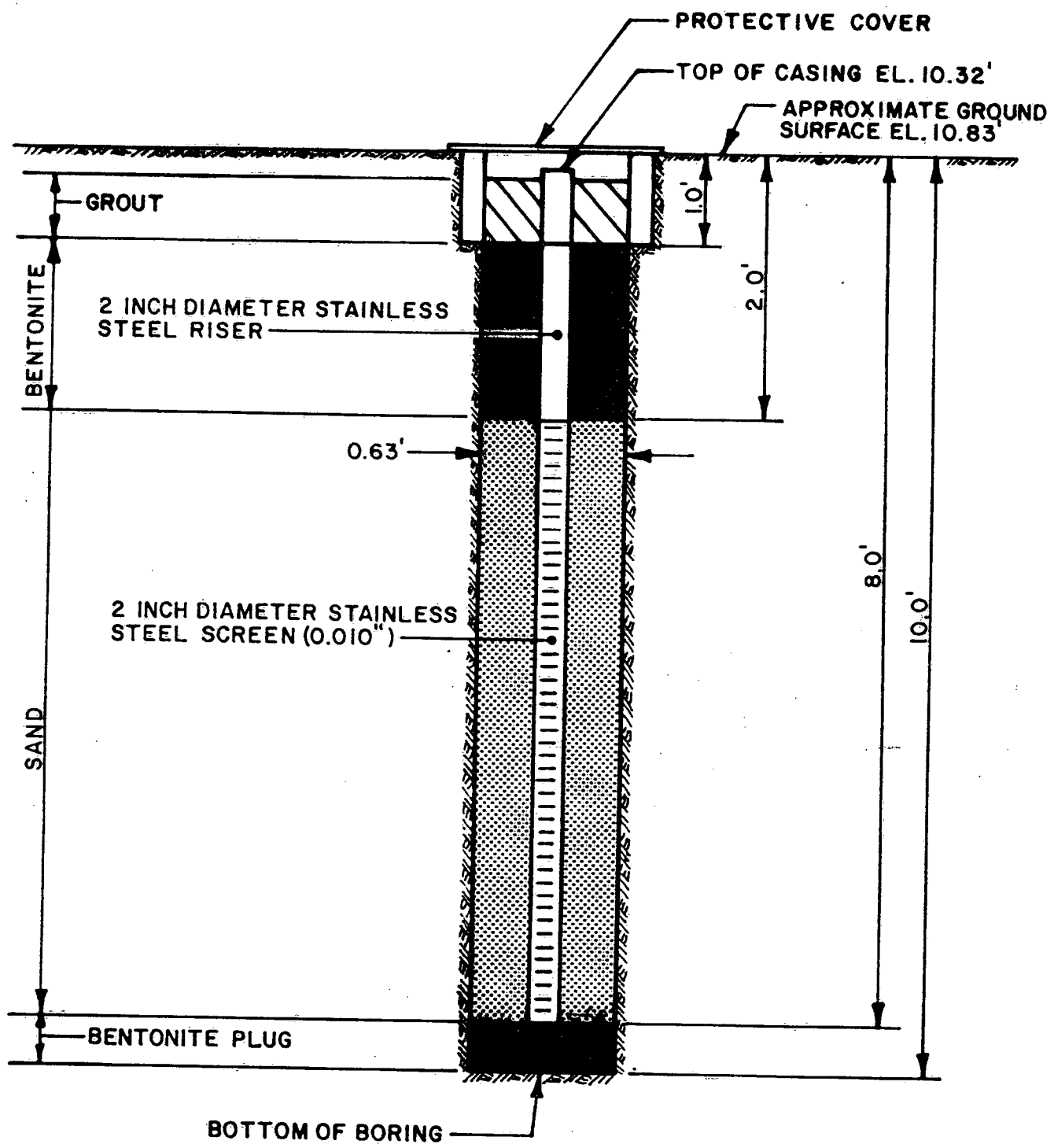


BOTTOM OF BORING
 "NOT TO SCALE"

FIGURE
 MONITORING WELL MW-9
 PREPARED FOR
 UNION CHEMICALS
 CARTERET, NEW JERSEY

DRAWING 671030-A12

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BY	10-23-85	APPROVED BY	



BOTTOM OF BORING

"NOT TO SCALE"

FIGURE

MONITORING WELL MW-10

PREPARED FOR

UNION CHEMICALS
CARTERET, NEW JERSEY



DRAWING NUMBER 671030-A13

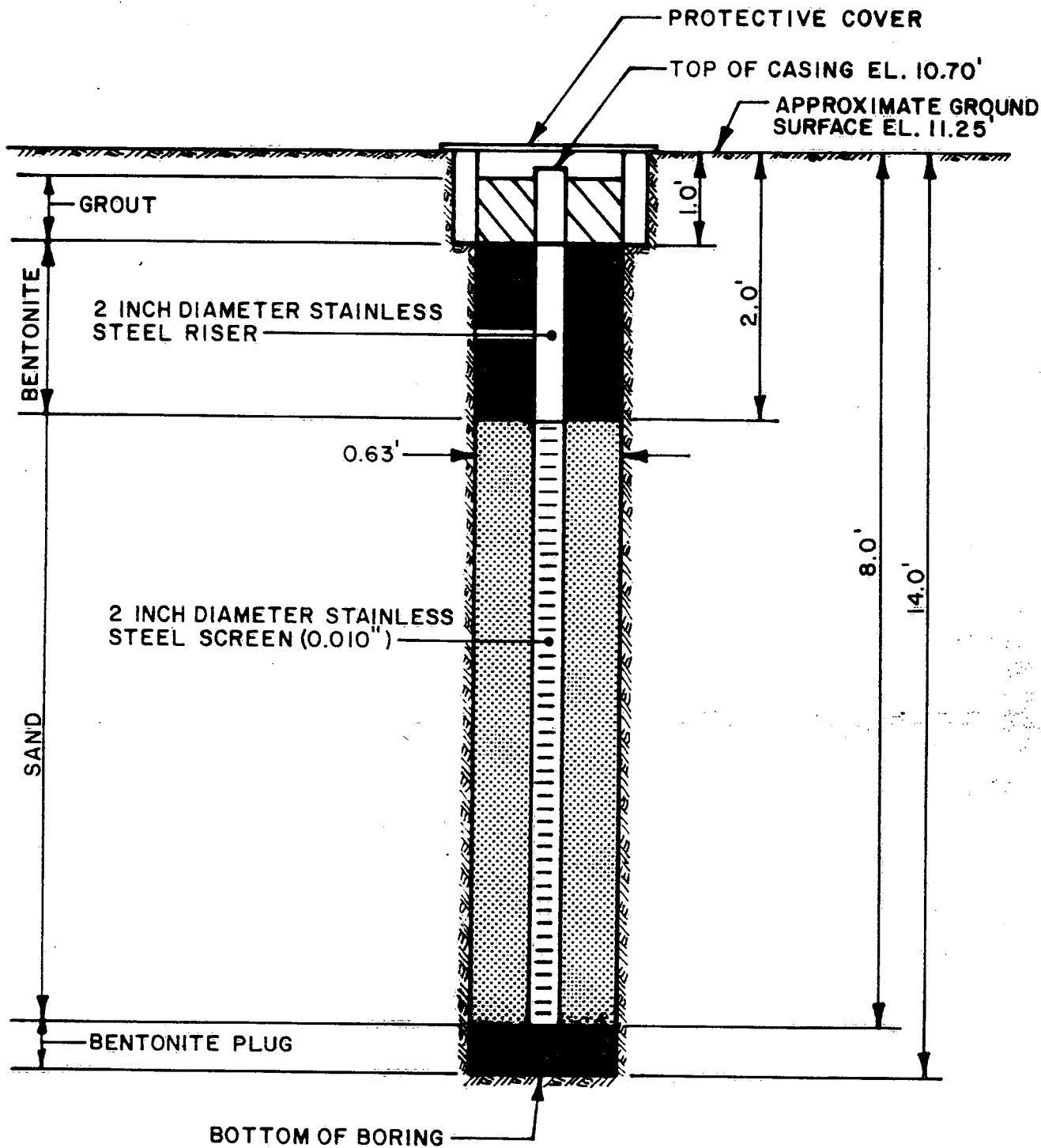
CHECKED BY

10-23-85

APPROVED BY

me

DRAWN BY



"NOT TO SCALE"

FIGURE

MONITORING WELL MW-II

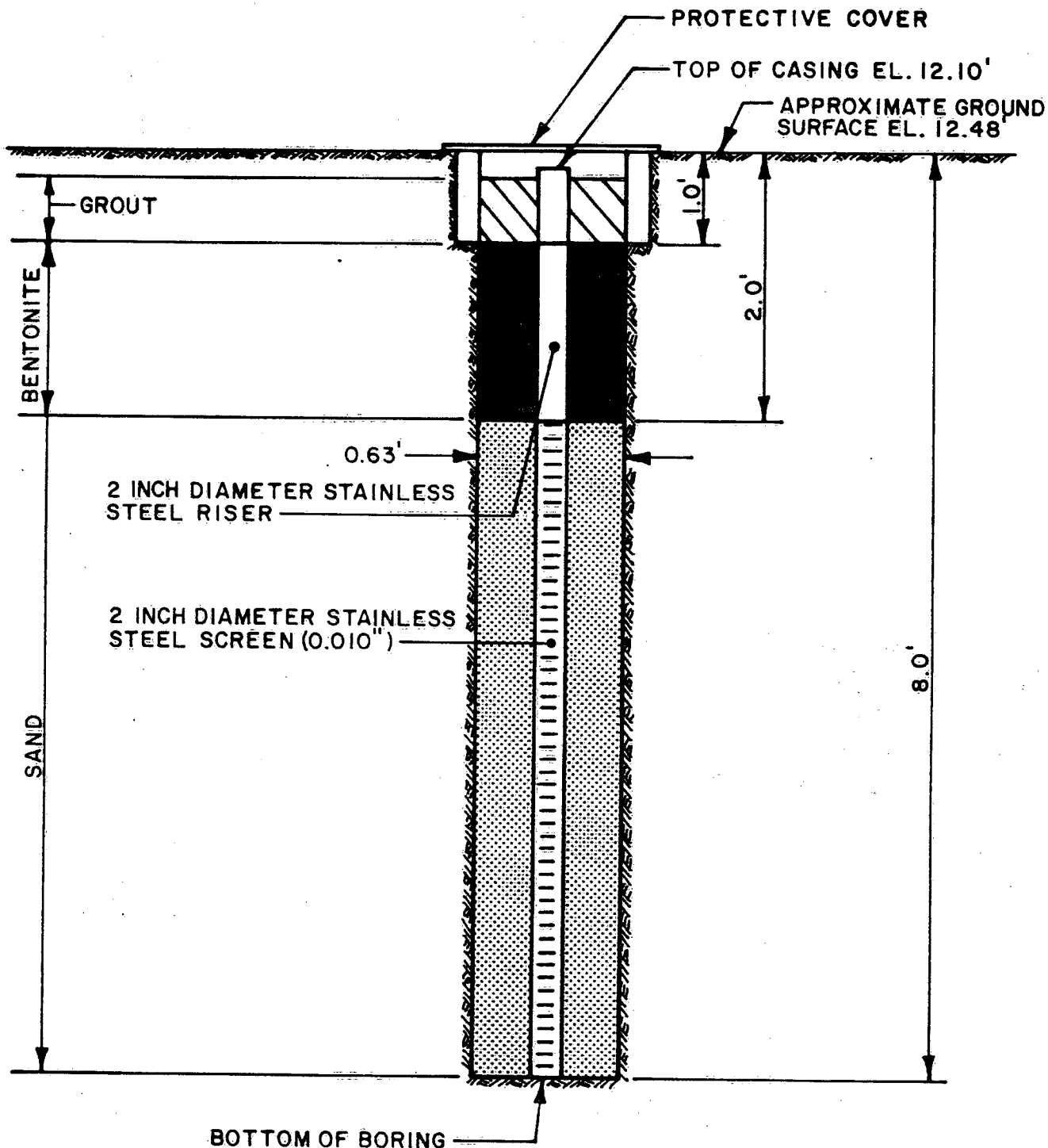
PREPARED FOR

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CARTERET, NEW JERSEY

DRAWING NUMBER 671030-A14

me1
10-23-85
DRAWN BY

CHECKED BY
APPROVED BY



"NOT TO SCALE"

FIGURE

MONITORING WELL MW-12

PREPARED FOR

UNION CHEMICALS
CARTERET, NEW JERSEY



TABLE 1 FOOTNOTES

- (1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.
- (2) mg/l = milligrams per liter or parts per million.
- (3) The indicated compound is incorrectly identified in Part C of NPDES Form 2C as 1,2-Dichloropropylene. However, the sample was screened for the presence of both compounds.

APPENDIX C
LABORATORY ANALYTICAL RESULTS



IT CORPORATION

Memorandum

To: ✓ D. E. Brunner
P. D. Holzman
R. N. Johnsen
From: R. M. Burke
S. H. Cochenour *SHC 7/31/85*
D. J. Nestasie *DJN 7/31/85*
Subject: Transmittal
Analytical Results for Union Chemical
Project No. 611046.11

Date: July 30, 1985

The IT Analytical Services (ITAS) Murrysville Laboratory has completed the analysis of the three samples received in the laboratory on July 3, 1985. Results of the analyses are presented in the enclosed tables and were determined in accordance with U.S. Environmental Protection Agency analytical procedures.

Should you have any questions or need additional information, please contact us at the Murrysville Laboratory.

RMB;SHC;DJN:ws

TABLE 1
 WATER, OIL AND SOIL ANALYSIS SUMMARY
 OF SELECTED VOLATILE PRIORITY POLLUTANT COMPOUNDS
 FOR UNION CHEMICAL
 PROJECT NO. 611046.11

PARAMETER	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION		
		U-1W WATER LAYER mg/l ⁽²⁾	U-1W OIL LAYER mg/l	U-2S SOIL mg/kg ⁽³⁾
Benzene	71-43-2	8.2	1,000	0.20
Toluene	108-88-3	7.7	3,600	<0.10
Total xylenes	95-47-6	100	64,000	0.44

(1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

(2) mg/l = milligrams per liter or parts per million.

(3) mg/kg = milligrams per kilogram or parts per million.

TABLE 2
 SURROGATE SPIKE PERCENT RECOVERY SUMMARY
 OF VOLATILE PRIORITY POLLUTANT COMPOUNDS
 FOR UNION CHEMICAL
 PROJECT NO. 611046.11

SAMPLE IDENTIFICATION	PARAMETER	
	TOLUENE-d ₈	4,-BROMOFLUOROBENZENE
	Percent Recovery	
U-1W, Water Layer	101%	95.9%
U-1W, Oil Layer	100%	115%
U-2S, Soil	101%	94.5%



Memorandum

To: D. Holzman

Date: August 13, 1985

From: R. M. Burke *RMB 8/14/85*
S. H. Cochenour *SHC 8-14-85*

Subject: Transmittal
Laboratory Analysis for Union Chemical
Project No. 611046

The IT Analytical Services (ITAS) Murrysville Laboratory has completed the analysis of the one water sample and two soil samples received in the laboratory on July 30, 1985. Results of the analyses are presented in the enclosed tables and were determined in accordance with U.S. Environmental Protection Agency analytical procedures.

Should you have any questions or need additional information, please contact us at the Murrysville Laboratory.

SHC;RMB:ws

TABLE 1
WATER ANALYSIS SUMMARY
OF VOLATILE PRIORITY POLLUTANT RESULTS
FOR UNION CHEMICAL
PROJECT NO. 611046

PARAMETER	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION
		U-4-W Concentration mg/l ⁽²⁾
Acrolein	107-02-8	<1.0
Acrylonitrile	107-13-1	<1.0
Benzene	71-43-2	14
Bromoform	75-25-2	<0.10
Carbon Tetrachloride	56-23-5	<0.10
Chlorobenzene	108-90-7	37
Chlorodibromomethane	124-48-1	<0.10
Chloroethane	75-00-3	<1.0
2-Chloroethylvinyl ether	110-75-8	<0.10
Chloroform	67-66-3	<0.10
Dichlorobromomethane	75-27-4	<0.10
1,1-Dichloroethane	75-34-3	<0.10
1,2-Dichloroethane	107-06-2	<0.10
1,1-Dichloroethylene	75-35-4	<0.10
1,2-Dichloropropane	78-87-5	<0.10
1,3-Dichloropropylene ⁽³⁾	542-75-6	<0.10
Ethylbenzene	100-41-4	1.4
Methyl bromide	74-83-9	<1.0
Methyl chloride	74-87-3	<1.0
Methylene chloride	75-09-2	<0.10
1,1,2,2-Tetrachloroethane	79-34-5	<0.10
Tetrachloroethylene	127-18-4	<0.10
Toluene	108-88-3	0.64
trans-1,2-Dichloroethylene	156-60-5	<0.10
1,1,1-Trichloroethane	71-55-6	<0.10
1,1,2-Trichloroethane	79-00-5	<0.10
Trichloroethylene	79-01-6	<0.10
Trichlorofluoromethane	75-69-4	<0.10
Vinyl Chloride	75-01-4	<1.0

TABLE 2
SOIL ANALYSIS SUMMARY
OF VOLATILE PRIORITY POLLUTANT RESULTS
FOR UNION CHEMICAL
PROJECT NO. 611046

PARAMETER	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION	
		U-TP-2	U-TP-4
		Concentration mg/kg ⁽²⁾	
Acrolein	107-02-8	<0.10	<0.10
Acrylonitrile	107-13-1	<0.10	<0.10
Benzene	71-43-2	0.064	0.033
Bromoform	75-25-2	<0.010	<0.010
Carbon Tetrachloride	56-23-5	<0.010	<0.010
Chlorobenzene	108-90-7	0.95	0.65
Chlorodibromomethane	124-48-1	<0.010	<0.010
Chloroethane	75-00-3	<0.10	<0.10
2-Chloroethylvinyl ether	110-75-8	<0.010	<0.010
Chloroform	67-66-3	<0.010	<0.010
Dichlorobromomethane	75-27-4	<0.010	<0.010
1,1-Dichloroethane	75-34-3	0.074	<0.010
1,2-Dichloroethane	107-06-2	<0.010	<0.010
1,1-Dichloroethylene	75-35-4	<0.010	<0.010
1,2-Dichloropropane	78-87-5	<0.010	<0.010
1,3-Dichloropropylene ⁽³⁾	542-75-6	<0.010	<0.010
Ethylbenzene	100-41-4	0.017	0.069
Methyl bromide	74-83-9	<0.10	<0.10
Methyl chloride	74-87-3	<0.10	<0.10
Methylene chloride	75-09-2	0.16	0.077
1,1,2,2-Tetrachloroethane	79-34-5	<0.010	<0.010
Tetrachloroethylene	127-18-4	2.1	0.019
Toluene	108-88-3	<0.010	<0.010
trans-1,2-Dichloroethylene	156-60-5	<0.010	<0.010
1,1,1-Trichloroethane	71-55-6	0.51	<0.010
1,1,2-Trichloroethane	79-00-5	<0.010	<0.010
Trichloroethylene	79-01-6	0.085	<0.010
Trichlorofluoromethane	75-69-4	<0.010	<0.010
Vinyl Chloride	75-01-4	<0.10	<0.10

TABLE 2 FOOTNOTES

- (1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.
- (2) mg/kg = milligrams per kilogram or parts per million.
- (3) The indicated compound is incorrectly identified in Part C of NPDES Form 2C as 1,2-Dichloropropylene. However, the sample was screened for the presence of both compounds.

TABLE 3
WATER ANALYSIS SUMMARY
OF VOLATILE NON-PRIORITY POLLUTANT COMPOUNDS
FOR UNION CHEMICAL
PROJECT NO. 611046

PARAMETERS	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION
		U-4-W Concentration mg/l ⁽²⁾
Acetone	67-64-1	<1.0
2-Butanone	78-93-3	<1.0
Carbon disulfide	75-15-0	<0.10
2-Hexanone	591-78-6	<1.0
4-Methyl-2-pentanone	108-10-1	2.7
Styrene	100-42-5	0.69
Vinyl acetate	108-05-4	<1.0
Total xylenes	95-47-6	0.61

(1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

(2) mg/l = milligrams per liter or parts per million.

TABLE 4
SOIL ANALYSIS SUMMARY
OF VOLATILE NON-PRIORITY POLLUTANT COMPOUNDS
FOR UNION CHEMICAL
PROJECT NO. 611046

PARAMETERS	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION	
		U-TP-2	U-TP-4
		Concentration mg/kg ⁽²⁾	
Acetone	67-64-1	0.24	<0.10
2-Butanone	78-93-3	<0.10	<0.10
Carbon disulfide	75-15-0	<0.010	<0.010
2-Hexanone	591-78-6	<0.10	<0.10
4-Methyl-2-pentanone	108-10-1	<0.10	<0.10
Styrene	100-42-5	<0.010	<0.010
Vinyl acetate	108-05-4	<0.10	<0.10
Total xylenes	95-47-6	0.12	0.52

(1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

(2) mg/kg = milligrams per kilogram or parts per million.

TABLE 5

SURROGATE SPIKE PERCENT RECOVERY SUMMARY
OF VOLATILE PRIORITY POLLUTANT COMPOUNDS
FOR UNION CHEMICAL
PROJECT NO. 611046

SAMPLE IDENTIFICATION	4-BROMOFLUOROBENZENE	1,2-DICHLOROETHANE-d ₄	TOLUENE-d ₈
		Percent Recovery	
U-4-W	89.4%	85.1%	93.2%
U-TP-2	84.8%	67.8%	93.0%
U-TP-4	84.2%	69.0%	97.2%



IT CORPORATION

Memorandum

To: J. Hosler
D. Holzman
G. Gaillot

Date: October 10, 1985

From: R. M. Burke
S. H. Cochenour
D. J. Nestasie

2M310/11/85
HK 10/11/85
DJN 10/11/85

Subject: Transmittal
Analytical Results for Union Chemicals, Carteret, New Jersey
Project No. 67-1030

IT Analytical Services (ITAS) Murrysville Laboratory has completed the analysis of the seventeen water and two soil samples received in our laboratory on September 9, 1985. Results of the analyses are presented in the enclosed tables and were determined in accordance with U.S. Environmental Protection Agency and Standard Methods, 16th Ed. analytical procedures.

Should you have any questions or need additional information, please contact us at the Murrysville Laboratory.

RMB:SHC:DJN:pas

Enclosures

TABLE 1
WATER ANALYSIS SUMMARY
OF VOLATILE PRIORITY POLLUTANT RESULTS
FOR UNION CHEMICALS, CARTERET, NEW JERSEY
PROJECT NO. 67-1030

PARAMETER	CAS NUMBER ⁽¹⁾	MW-1T	SAMPLE IDENTIFICATION			MW-4T
			MW-2T	MW-3T	Concentration $\mu\text{g}/\ell$ ⁽²⁾	
Acrolein	107-02-8	<10	<10	<10		<10
Acrylonitrile	107-13-1	<10	<10	<10		<10
Benzene	71-43-2	7.3	22	22		2200
Bromoform	75-25-2	<1.0	<1.0	<1.0		<1.0
Carbon Tetrachloride	56-23-5	<1.0	<1.0	<1.0		<1.0
Chlorobenzene	108-90-7	17	150	41		4200
Chlorodibromomethane	124-48-1	<1.0	<1.0	<1.0		<1.0
Chloroethane	75-00-3	<1.0	6.8	25		1600
2-Chloroethylvinyl ether	110-75-8	<1.0	<1.0	<1.0		<1.0
Chloroform	67-66-3	<1.0	<1.0	<1.0		<1.0
Dichlorobromomethane	75-27-4	<1.0	<1.0	<1.0		<1.0
1,1-Dichloroethane	75-34-3	2.5	46	4.2		120
1,2-Dichloroethane	107-06-2	<1.0	<1.0	<1.0		9.9
1,1-Dichloroethylene	75-35-4	<1.0	8.6	<1.0		<1.0
1,2-Dichloropropane	78-87-5	<1.0	<1.0	<1.0		<1.0
1,3-Dichloropropylene ⁽³⁾	542-75-6	<1.0	<1.0	<1.0		64
Ethylbenzene	100-41-4	<1.0	<1.0	<1.0		280
Methyl bromide	74-83-9	<10	<10	<10		<10
Methyl chloride	74-87-3	<10	<10	<10		<10
Methylene chloride	75-09-2	<10	<10	<10		<10
1,1,2,2-Tetrachloroethane	79-34-5	<1.0	<1.0	<1.0		<1.0
Tetrachloroethylene	127-18-4	<1.0	1.0	<1.0		2.8
Toluene	108-88-3	1.0	6.6	<1.0		2800
trans-1,2-Dichloroethylene	156-60-5	<1.0	2.8	1.3		62
1,1,1-Trichloroethane	71-55-6	<1.0	87	54		44
1,1,2-Trichloroethane	79-00-5	<1.0	<1.0	<1.0		<1.0
Trichloroethylene	79-01-6	<1.0	2.2	<1.0		<1.0
Vinyl Chloride	75-01-4	<10	<10	<10		15

TABLE 1
(Continued)

PARAMETER	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION			
		MW-5T	MW-6B Concentration	MW-6T µg/l ⁽²⁾	MW-7T
Acrolein	107-02-8	<10	<100	<10	<10
Acrylonitrile	107-13-1	<10	<100	<10	<10
Benzene	71-43-2	2500	49,000	85,000	320
Bromoform	75-25-2	<1.0	<10	<1.0	<1.0
Carbon Tetrachloride	56-23-5	<1.0	<10	<1.0	<1.0
Chlorobenzene	108-90-7	23,000	230,000	150,000	2000
Chlorodibromomethane	124-48-1	<1.0	<10	<1.0	2.7
Chloroethane	75-00-3	55	<10	4.1	<1.0
2-Chloroethylvinyl ether	110-75-8	<1.0	<10	<1.0	<1.0
Chloroform	67-66-3	<1.0	<10	<1.0	12
Dichlorobromomethane	75-27-4	<1.0	<10	<1.0	<1.0
1,1-Dichloroethane	75-34-3	12	<10	2.5	<1.0
1,2-Dichloroethane	107-06-2	3.7	<10	<1.0	2.4
1,1-Dichloroethylene	75-35-4	<1.0	<10	<1.0	<1.0
1,2-Dichloropropane	78-87-5	<1.0	<10	<1.0	<1.0
1,3-Dichloropropylene ⁽³⁾	542-75-6	<1.0	<10	<1.0	<1.0
Ethylbenzene	100-41-4	2700	<10	2600	230
Methyl bromide	74-83-9	<10	<100	<10	<10
Methyl chloride	74-87-3	<10	<100	<10	<10
Methylene chloride	75-09-2	<10	630	21	<10
1,1,2,2-Tetrachloroethane	79-34-5	15	<10	<1.0	<1.0
Tetrachloroethylene	127-18-4	<1.0	200	320	<1.0
Toluene	108-88-3	570	2700	5200	37
trans-1,2-Dichloroethylene	156-60-5	1.0	640	74	2.4
1,1,1-Trichloroethane	71-55-6	<1.0	<10	4.1	450
1,1,2-Trichloroethane	79-00-5	<1.0	<10	<1.0	<1.0
Trichloroethylene	79-01-6	<1.0	<10	11	<1.0
Vinyl Chloride	75-01-4	<10	<100	10	<10

TABLE 1
(Continued)

PARAMETER	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION			
		MW-8B	MW-8T Concentration	MW-9B ug/l ⁽²⁾	MW-9T
Acrolein	107-02-8	<10	<10	<10	<10
Acrylonitrile	107-13-1	<10	<10	<10	<10
Benzene	71-43-2	17,000	18,000	2800	2300
Bromoform	75-25-2	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	56-23-5	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	108-90-7	140,000	130,000	1500	230
Chlorodibromomethane	124-48-1	<1.0	<1.0	<1.0	<1.0
Chloroethane	75-00-3	<1.0	<1.0	65	67
2-Chloroethylvinyl ether	110-75-8	<1.0	<1.0	<1.0	<1.0
Chloroform	67-66-3	<1.0	<1.0	<1.0	<1.0
Dichlorobromomethane	75-27-4	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	75-34-3	5.6	4.1	7.7	6.0
1,2-Dichloroethane	107-06-2	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethylene	75-35-4	1.7	1.4	<1.0	<1.0
1,2-Dichloropropane	78-87-5	<1.0	<1.0	<1.0	<1.0
1,3-Dichloropropylene ⁽³⁾	542-75-6	<1.0	<1.0	79	37
Ethylbenzene	100-41-4	1400	1800	300	44
Methyl bromide	74-83-9	<10	<10	<10	<10
Methyl chloride	74-87-3	14	<10	<10	<10
Methylene chloride	75-09-2	<10	<10	<10	<10
1,1,2,2-Tetrachloroethane	79-34-5	<1.0	<1.0	<1.0	<1.0
Tetrachloroethylene	127-18-4	940	1100	<1.0	<1.0
Toluene	108-88-3	990	580	18	<1.0
trans-1,2-Dichloroethylene	156-60-5	280	220	4.6	<1.0
1,1,1-Trichloroethane	71-55-6	330	280	15	110
1,1,2-Trichloroethane	79-00-5	<1.0	<1.0	<1.0	<1.0
Trichloroethylene	79-01-6	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	75-01-4	49	60	<10	10

TABLE 1
(Continued)

PARAMETER	CAS NUMBER ⁽¹⁾	MW-10B	SAMPLE IDENTIFICATION				MW-11T
			MW-10T	MW-11B			
			Concentration $\mu\text{g}/\ell$ ⁽²⁾				
Acrolein	107-02-8	<10	<10	<10	<10	<10	
Acrylonitrile	107-13-1	<10	<10	<10	<10	<10	
Benzene	71-43-2	120	61	240	240	<1.0	
Bromoform	75-25-2	<1.0	<1.0	<1.0	<1.0	<1.0	
Carbon Tetrachloride	56-23-5	<1.0	<1.0	<1.0	<1.0	<1.0	
Chlorobenzene	108-90-7	13	<1.0	310	300	16	
Chlorodibromomethane	124-48-1	<1.0	<1.0	<1.0	<1.0	<1.0	
Chloroethane	75-00-3	47	38	6.6	5.9	<1.0	
2-Chloroethylvinyl ether	110-75-8	<1.0	<1.0	<1.0	<1.0	<1.0	
Chloroform	67-66-3	<1.0	<1.0	<1.0	<1.0	<1.0	
Dichlorobromomethane	75-27-4	<1.0	<1.0	<1.0	<1.0	<1.0	
1,1-Dichloroethane	75-34-3	<1.0	<1.0	<1.0	<1.0	1.1	
1,2-Dichloroethane	107-06-2	<1.0	<1.0	1.1	<1.0	<1.0	
1,1-Dichloroethylene	75-35-4	<1.0	<1.0	<1.0	<1.0	<1.0	
1,2-Dichloropropane	78-87-5	<1.0	<1.0	<1.0	<1.0	<1.0	
1,3-Dichloropropylene ⁽³⁾	542-75-6	<1.0	<1.0	6.2	6.0	<1.0	
Ethylbenzene	100-41-4	480	<1.0	<1.0	<1.0	<1.0	
Methyl bromide	74-83-9	<10	<10	<10	<10	<10	
Methyl chloride	74-87-3	<10	<10	<10	<10	<10	
Methylene chloride	75-09-2	<10	<10	<10	<10	<10	
1,1,2,2-Tetrachloroethane	79-34-5	<1.0	<1.0	2.2	<1.0	1.9	
Tetrachloroethylene	127-18-4	<1.0	<1.0	<1.0	<1.0	<1.0	
Toluene	108-88-3	220	2.1	3.0	1.8	<1.0	
trans-1,2-Dichloroethylene	156-60-5	<1.0	<1.0	<1.0	<1.0	1.4	
1,1,1-Trichloroethane	71-55-6	<1.0	<1.0	<1.0	<1.0	<1.0	
1,1,2-Trichloroethane	79-00-5	<1.0	<1.0	<1.0	<1.0	<1.0	
Trichloroethylene	79-01-6	<1.0	<1.0	<1.0	<1.0	<1.0	
Vinyl Chloride	75-01-4	<10	<10	<10	<10	<10	

TABLE 1 FOOTNOTES

- (1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.
- (2) $\mu\text{g}/\text{l}$ = micrograms per liter or parts per billion.
- (3) The indicated compound is incorrectly identified in Part C of NPDES Form 2C as 1,2-Dichloropropylene. However, the sample was screened for the presence of both compounds.

TABLE 2
 WATER ANALYSIS SUMMARY
 OF VOLATILE NON-PRIORITY POLLUTANT COMPOUNDS
 FOR UNION CHEMICALS, CARTERET, NEW JERSEY
 PROJECT NO. 67-1030

PARAMETERS	CAS NUMBER ⁽¹⁾	MW-1T	SAMPLE IDENTIFICATION			
			Concentration $\mu\text{g}/\ell$ ⁽²⁾			
			MW-2T	MW-3T	MW-4T	
Acetone	67-64-1	<10	<10	<10	16	
2-Butanone	78-93-3	<10	<10	<10	<10	
Carbon disulfide	75-15-0	13	18	<10	46	
2-Hexanone	591-78-6	<10	<10	<10	<10	
4-Methyl-2-pentanone	108-10-1	<10	<10	<10	26	
Styrene	100-42-5	<1.0	<1.0	<1.0	7.6	
Vinyl acetate	108-05-4	<10	<10	<10	<10	
Xylenes, Total	95-47-6	<1.0	<1.0	<1.0	920	

TABLE 2
(Continued)

PARAMETERS	CAS NUMBER ⁽¹⁾	MW-5T	SAMPLE IDENTIFICATION		
			Concentration $\mu\text{g}/\ell$ ⁽²⁾		
			MW-6B	MW-6T	MW-7T
Acetone	67-64-1	28	<100	<10	65
2-Butanone	78-93-3	100	<100	<10	62
Carbon disulfide	75-15-0	<10	<100	<10	<10
2-Hexanone	591-78-6	<10	<100	<10	<10
4-Methyl-2-pentanone	108-10-1	<10	<100	<10	<10
Styrene	100-42-5	39	<10	250	<1.0
Vinyl acetate	108-05-4	<10	<100	<10	<10
Xylenes, Total	95-47-6	4500	2200	24,000	890

TABLE 2
(Continued)

PARAMETERS	CAS NUMBER ⁽¹⁾	MW-8B	SAMPLE IDENTIFICATION		
			Concentration $\mu\text{g}/\ell$ ⁽²⁾		
			MW-8T	MW-9B	MW-9T
Acetone	67-64-1	22	12	17	<10
2-Butanone	78-93-3	89	<10	78	100
Carbon disulfide	75-15-0	<10	<10	<10	<10
2-Hexanone	591-78-6	<10	<10	<10	<10
4-Methyl-2-pentanone	108-10-1	<10	<10	<10	<10
Styrene	100-42-5	210	180	45	<1.0
Vinyl acetate	108-05-4	<10	<10	<10	<10
Xylenes, Total	95-47-6	750	620	1500	250

TABLE 2
(Continued)

PARAMETERS	CAS NUMBER ⁽¹⁾	MW-10B	SAMPLE IDENTIFICATION		
			Concentration $\mu\text{g}/\ell$ ⁽²⁾		
			MW-10T	MW-11B	MW-11T
Acetone	67-64-1	<10	<10	<10	<10
2-Butanone	78-93-3	<10	<10	<10	<10
Carbon disulfide	75-15-0	48	18	<10	48
2-Hexanone	591-78-6	<10	<10	<10	<10
4-Methyl-2-pentanone	108-10-1	<10	<10	<10	<10
Styrene	100-42-5	110	<1.0	<1.0	<1.0
Vinyl acetate	108-05-4	<10	<10	<10	<10
Xylenes, Total	95-47-6	10,000	540	<1.0	<1.0

TABLE 2
(Continued)

PARAMETERS	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION
		Concentration $\mu\text{g}/\text{l}$ ⁽²⁾ MW-12T
Acetone	67-64-1	<10
Carbon disulfide	75-15-0	28
2-Hexanone	591-78-6	<10
4-Methyl-2-pentanone	108-10-1	<10
Styrene	100-42-5	<1.0
Vinyl acetate	108-05-4	<10
Xylenes, Total	95-47-6	<1.0

(1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

(2) $\mu\text{g}/\text{l}$ = micrograms per liter or parts per billion.

TABLE 3
SOIL ANALYSIS SUMMARY
OF VOLATILE PRIORITY POLLUTANT RESULTS
FOR UNION CHEMICALS, CARTERET, NEW JERSEY
PROJECT NO. 67-1030

PARAMETER	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION	
		NC-D Concentration	NC-U µg/kg ⁽²⁾
Acrolein	107-02-8	<100	<100/<100 ⁽⁴⁾
Acrylonitrile	107-13-1	<100	<100/<100
Benzene	71-43-2	<10	<10/<10
Bromoform	75-25-2	<10	<10/<10
Carbon Tetrachloride	56-23-5	<10	<10/<10
Chlorobenzene	108-90-7	<10	<10/<10
Chlorodibromomethane	124-48-1	<10	<10/<10
Chloroethane	75-00-3	<10	<10/<10
2-Chloroethylvinyl ether	110-75-8	<10	<10/<10
Chloroform	67-66-3	<10	<10/<10
Dichlorobromomethane	75-27-4	<10	<10/<10
1,1-Dichloroethane	75-34-3	<10	<10/<10
1,2-Dichloroethane	107-06-2	<10	<10/<10
1,1-Dichloroethylene	75-35-4	<10	<10/<10
1,2-Dichloropropane	78-87-5	<10	<10/<10
1,3-Dichloropropylene ⁽³⁾	542-75-6	<10	<10/<10
Ethylbenzene	100-41-4	<10	<10/<10
Methyl bromide	74-83-9	<100	<100/<100
Methyl chloride	74-87-3	<100	<100/<100
Methylene chloride	75-09-2	<100	<100/<100
1,1,2,2-Tetrachloroethane	79-34-5	<10	<10/<10
Tetrachloroethylene	127-18-4	<10	<10/<10
Toluene	108-88-3	<10	<10/<10
trans-1,2-Dichloroethylene	156-60-5	<10	<10/<10
1,1,1-Trichloroethane	71-55-6	<10	<10/<10
1,1,2-Trichloroethane	79-00-5	<10	<10/<10
Trichloroethylene	79-01-6	<10	<10/<10
Vinyl Chloride	75-01-4	<100	<100/<100

TABLE 3 FOOTNOTES

- (1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.
- (2) $\mu\text{g}/\text{kg}$ = micrograms per kilogram or parts per billion.
- (3) The indicated compound is incorrectly identified in Part C of NPDES Form 2C as 1,2-Dichloropropylene. However, the sample was screened for the presence of both compounds.
- (4) The indicated sample was analyzed in duplicate.

TABLE 4
SOIL ANALYSIS SUMMARY
OF VOLATILE NON-PRIORITY POLLUTANT COMPOUNDS
FOR UNION CHEMICALS, CARTERET, NEW JERSEY
PROJECT NO. 67-1030

PARAMETER	CAS NUMBER ⁽¹⁾	SAMPLE IDENTIFICATION		
		UNITS ⁽²⁾	NC-D	NC-U
Acetone	67-64-1	µg/kg	<100	<100/<100 ⁽³⁾
2-Butanone	78-93-3	µg/kg	<100	<100/<100
Carbon disulfide	75-15-0	µg/kg	<100	<100/<100
2-Hexanone	591-78-6	µg/kg	<100	<100/<100
4-Methyl-2-pentanone	108-10-1	µg/kg	<100	<100/<100
Styrene	100-42-5	µg/kg	<10	<10/<10
Vinyl acetate	108-05-4	µg/kg	<100	<100/<100
Xylene, Total	85-47-6	µg/kg	<10	<10/<10

(1) The numbers presented in this column are the Chemical Abstracts Service (CAS) numbers used for cataloging the indicated compounds in the Chemical Abstracts Index.

(2) µg/kg = micrograms per kilogram or parts per billion.

(3) The indicated sample was analyzed in duplicate.

TABLE 5

MATRIX SPIKE PERCENT RECOVERY SUMMARY
OF VOLATILE PRIORITY POLLUTANT RESULTS
FOR UNION CHEMICALS, CARTERET, NEW JERSEY
PROJECT NO. 67-1030

PARAMETER	SAMPLE IDENTIFICATION	
	NC-U	MW-10T
	Percent Recovery	
Benzene	91.6%	96.5%
Chlorobenzene	94.2%	102%
1,1-Dichloroethene	94.3%	99.8%
Toluene	93.8%	94.2%
Trichloroethene	103%	109%

TABLE 6
 SURROGATE SPIKE PERCENT RECOVERY SUMMARY
 OF VOLATILE PRIORITY POLLUTANT
 FOR UNION CHEMICALS, CARTERET, NEW JERSEY
 PROJECT NO. 67-1030

SAMPLE IDENTIFICATION	PARAMETER		
	4-BROMOFLUOROBENZENE	1,2-DICHLOROETHANE-d ₄	TOLUENE-d ₈
	Percent Recovery		
MW-1T	111%	85.0%	95.7%
MW-2T	97.8%	86.9%	97.6%
MW-3T	102%	86.3%	93.8%
MW-4T	111%	86.5%	81.4%
MW-5T	91.9%	90.0%	93.4%
MW-6B	96.0%	85.4%	90.8%
MW-6T	84.4%	117%	111%
MW-7T	85.4%	120%	110%
MW-8B	89.7%	86.8%	91.0%
MW-8T	85.8%	86.1%	88.4%
MW-9B	88.9%	120%	108%
MW-9T	99.5%	84.6%	87.7%
MW-10B	102%	83.2%	86.2%
MW-10T	95.6%	91.3%	99.2%
MW-11B	103%	87.2%	92.5%
MW-11T	98.1%	84.3%	88.2%
MW-12T	110%	91.6%	97.5%
NC-D	101%	78.7%	92.8%
NC-U	94.0%/94.6% ⁽¹⁾	81.3%/79.2%	96.6%/95.9%

⁽¹⁾The indicated sample was analyzed in duplicate.

TABLE 7
 WATER ANALYSIS SUMMARY
 OF TOTAL ORGANIC CARBON AND TOTAL ORGANIC HALOGEN SUMMARY
 FOR UNION CHEMICALS, CARTERET, NEW JERSEY
 PROJECT NO. 67-1030

SAMPLE IDENTIFICATION	TOTAL ORGANIC CARBON mg/l ⁽¹⁾	TOTAL ORGANIC HALOGEN mg/l
MW-1T	14	0.38
MW-2T	6	0.15
MW-3T	82	0.14
MW-4T	23	1.5
MW-5T	28	13
MW-6B	48	73
MW-6T	30	26
MW-7T	13	3.1
MW-8B	23	40
MW-8T	18	36
MW-9B	26	0.94
MW-9T	24	2.2
MW-10B	13	0.44
MW-10T	12	0.64
MW-11B	8	0.46
MW-11T	7	0.85
MW-12T	4	0.26

⁽¹⁾mg/l = milligrams per liter or parts per million.

TABLE 8
SOIL ANALYSIS SUMMARY
OF TOTAL ORGANIC CARBON AND TOTAL ORGANIC HALOGEN SUMMARY
FOR UNION CHEMICALS, CARTERET, NEW JERSEY
PROJECT NO. 67-1030

SAMPLE IDENTIFICATION	TOTAL ORGANIC CARBON mg/kg ⁽¹⁾	TOTAL ORGANIC HALOGEN mg/kg
NC-D	3500	0.40/0.46 ⁽²⁾
NC-U	3300	0.74

⁽¹⁾mg/kg = milligrams per kilograms or parts per million.

⁽²⁾The indicated sample was analyzed in duplicate.

TABLE 9
 WATER QUALITY ANALYSIS SUMMARY
 FOR UNION CHEMICALS, CARTERET, NEW JERSEY
 PROJECT NO. 67-1030

SAMPLE IDENTIFICATION	ALKALINITY mg/l ⁽¹⁾ CaCO ₃	CHLORIDE mg/l	SULFATE mg/l SO ₄ ⁻²
MW-1T	460	180	60
MW-5T	380	290	3
MW-8B	570/550 ⁽²⁾	220/220	4
MW-8T	510	210	3
MW-12T	270	13	15

(1) mg/l = milligrams per liter or parts per million.

(2) The indicated sample was analyzed in duplicate.

TABLE 10

MATRIX SPIKE PERCENT RECOVERY SUMMARY
FOR UNION CHEMICALS, CARTERET, NEW JERSEY
PROJECT NO. 67-1030

PARAMETER	PERCENT RECOVERY
Alkalinity	77.8%
Chloride	95.8%
Sulfate	92.8%